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NOTES FOR THE MONTH.

Agricultural Tribunal of Investigation.

THE Tribunal of Investigation appointed by the Prime Minister to inquire into the agricultural problem, to which reference was made in the January issue of the *Journal*, consists of the following economists:—Sir William Ashley, Professor of Commerce and Vice-Principal of the University of Birmingham; Professor W. G. S. Adams, Gladstone Professor of Political Theory and Institutions, Oxford; and Professor D. H. MacGregor, Drummond Professor of Political Economy, Oxford.

Mr. C. S. Orwin, Director of the Institute for Research in Agricultural Economics at Oxford, has been appointed Agricultural Assessor to the Tribunal, and Mr. D. B. Toye, of the Ministry of Agriculture and Fisheries, will act as Secretary.

The Tribunal has now held thirteen meetings at which agricultural conditions, both in Great Britain and in other countries, have been investigated and discussed. In addition, the Tribunal has received evidence from several witnesses.

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Committee on the Distribution and Prices of Agricultural Produce.

THE Departmental Committee on the Prices and Distribution of Agricultural Produce, under the Chairmanship of the Marquess of Linlithgow, has made rapid strides during the month of January in the direction of hearing evidence. So far, the Committee has provisionally heard witnesses regarding milk, fruit and vegetables, and meat, but the evidence is by no means complete in respect of any of these commodities. The Committee is now concentrating its efforts upon milk, and it is anticipated that it

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will be fully occupied with hearing the remaining evidence in connection with this branch of the inquiry until Parliament reassembles. It is understood that the Committee then proposes to issue an interim report dealing with milk alone, after which it will proceed, in the same way, to issue separate reports in respect of fruit and vegetables, meat, cereals, and bread.

Inquiries are necessarily prolonged in a subject so complex and difficult as that with which the Committee has been appointed to deal. A considerable number of trade organisations and other representative bodies have to be heard in respect of each commodity. As regards milk, for instance, evidence has already been received from such organisations as The British Dairy Farmers' Association, the Agricultural Organisation Society, the National Farmers' Union, the London and Provincial Master Dairymen's Association, the National Society of Creamery Proprietors and Wholesale Dairymen, the National Citizens' Union, United Dairies Limited, and from Nestlé's Milk Company, as well as from the wholesale and retail branches of the co-operative movement, and before the inquiry as regards milk is brought to a close, it will be necessary to hear evidence from many other organisations, including those representing Scotland.

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Eradication of Glanders in Great Britain.

IN the Report of the Chief Veterinary Officer for 1921 is recorded one of the outstanding successes in the operations of the Ministry in the treatment of animal diseases under the Diseases of Animals Acts. This is the almost entire suppression of the disease known as Glanders or Farcy. Glanders is a serious disease in this country, usually confined to horses, asses and mules. It is generally fatal, and, as veterinarians and medical men know, the more to be feared because of the possibility that human beings may contract it by infection from an equine. It is also difficult of diagnosis in its early stages.

The Glanders or Farcy Order of 1920 requires all animals affected with the disease to be slaughtered and compensation for their loss paid to the owner. Before the passing of the Glanders Order of 1907, only horses showing clinical symptoms of the disease were slaughtered. That Order, however, laid down as an additional basis for diagnosis, the mallein test, and Local Authorities were empowered to apply that test

to any suspected horse, ass or mule. They were required to slaughter all animals reacting to the test, as well as all animals showing clinical symptoms of the disease. The reduction in the number of outbreaks year by year since the Order of 1907 came into force (1st January, 1908) affords striking proof of its efficacy. In 1907 there had been no fewer than 854 outbreaks of the disease, affecting 1,921 animals in Great Britain. In 1922, only 4 outbreaks were recorded for the year.

The Ministry has now issued a Circular Letter to all Local Authorities who are empowered to deal with animal diseases, stating that the Ministry is satisfied that Glanders has now been almost entirely eradicated from the country. In order, however, that the Ministry shall be enabled to announce the freedom of the country from the disease with greater confidence when the proper time arrives, it is desired that Local Authorities should furnish the fullest and most accurate information in regard to all future outbreaks, including the supply of specimens of the affected organs for expert examination at the Ministry's Veterinary Laboratory.

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The Agricultural Index Number.

THE index numbers of the prices of agricultural produce in England and Wales show that, on the whole, average prices were relatively lower during December than in the previous month, the average increase compared with the corresponding month in the years 1911 to 1913 being 59 per cent. in December against 62 per cent. in November. The percentage increase in each month since the beginning of 1920 is shown in the following table :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.
January	200	183	75
February	195	167	79
March	189	150	77
April	202	149	70
May	180	119	71
June	175	112	68
July	186	112	72
August	193	131	67
September	202	116	57
October	194	86	59
November	193	79	62
December	184	76	59

The following table shows the average increases during recent months in the values of the principal commodities :—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1922					1921.
	Aug.	Sept.	Oct.	Nov.	Dec.	Dec.
Wheat ...	53	23	24	32	32	45
Barley ...	48	26	29	34	17	56
Oats	59	31	33	38	36	45
Fat cattle ...	70	58	49	48	48	61
Fat sheep ...	103	90	90	87	81	44
Fat pigs ...	92	84	85	94	94	62
Dairy cows ...	67	63	69	74	72	95
Store cattle ...	42	33	30	29	28	39
Store sheep ...	114	109	106	93	83	43
Store pigs ...	128	125	135	148	151	75
Eggs... ...	64	96	104	98	63	133
Poultry ...	85	85	77	75	86	70
Milk	70	70	90	90	90	130
Butter ...	77	76	71	72	73	65
Cheese ...	51	41	36	55	60	29
Potatoes ...	14	1	3	8	7	129
Hay	54	52	45	45	47	41

Wheat remains practically stationary and oats show little change on the month, but barley shows a substantial decline. Prices of fat stock remain about the same, on the average, sheep alone showing a slight fall. There has been little variation in the average prices of dairy cows and store cattle, but a further rise is recorded for store pigs, while store sheep, although more than maintaining their price, were relatively cheaper in December than in November compared with the corresponding pre-war months. Prices of eggs fell heavily during December, and are now much lower than they were a year ago. Milk and butter again maintain their relative values, but a further rise in prices of cheese is recorded. Potatoes remain about the same.

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Conciliation Committees in Agriculture.

THE Merioneth and Montgomery Committee has reached an agreement for the payment of a rate of 31s. for a week of 58 hours to stockmen and wagoners and 28s. for 50 hours to other adult male workers. The agreement operates from the 15th January to the 30th April and includes a clause fixing the valuation of board and lodging at 16s. per week and board only at 13s. per week.

The agreement of the Derbyshire Committee for the payment of adult male workers at the rate of 7d. per hour on weekdays and 9d. per hour on Sundays has been extended until

the 14th February. The Cornwall Committee's agreement providing for the payment of 30s. for a week of 52 hours to adult male workers will continue in operation until the 31st March.

Average Wages.—It is estimated that the weekly wages of ordinary agricultural labourers in England and Wales averaged during December about 27s. 10d., *i.e.*, about 55 per cent. above the pre-war level. In several areas, especially in the North of England and in Wales, the wages were in excess of this amount, but in such areas the average working week was generally longer than in the lower paid counties.

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TURNIP THINNING AND HARVESTING.

TURNIPS and swedes are the most important root crop of the British farmer, about 900,000 acres being grown annually in England and Wales. It is one of the most expensive crops to grow, not only because of the cost of preparing the land for sowing and of the after cultivation, but also because of the amount of labour required for thinning or singling the early plants, and for lifting, topping, and tailing the matured crop. Machinery has as yet taken no very prominent part in thinning or harvesting operations, and with the co-operation of various manufacturers the Ministry arranged a series of investigations with a view to determining the cost and efficiency of mechanical methods in comparison with hand labour. Whilst the results which are set out in the following Reports are not entirely conclusive, they yet point to the possibility of machinery being devised which should lead to a reduction in costs.

It should be explained that the thinning investigation was confined to turnips, while the harvesting investigation was confined to swedes. The thinning or gapping of roots by machines does not effect complete singling and is best adapted to those root crops which are to be folded. Although the point has not actually been investigated, it is hardly open to question that when the roots are to be lifted and stored it is desirable for the young plants to be singled by hand, and it is very doubtful whether there would be an advantage in a preliminary thinning by machine. The conclusions to be drawn from the data relating to harvesting would apply equally well to a turnip

crop, the only reason for selecting a swede crop being that swedes are invariably lifted while turnips are as a rule fed off.

Thinning.—The first test of turnip thinners was carried out in 1921 at the Ministry's experimental farm at Methwold, Norfolk, where the land is very light and sandy. The crop, however, proved a failure owing to the droughty summer and it was not possible to obtain any definite results. The test was repeated in 1922, when three machines were employed. A team of four men was engaged for the purpose of obtaining comparative results. A field containing 16 acres of turnips sown on the flat was selected for the test, and 48 rows (approximately 2.7 acres) were allotted to each machine and to the team of 4 men. Records were taken of the time required for thinning a given acreage, the labour needed, and any other relevant factor. For obtaining information as to the comparative effects of each device, small control plots were marked out and observations taken of the number of roots before and after thinning; and subsequently, of the number and weight of matured roots lifted from each plot.

Observations on the performance of each device and summary of results:—

(1) *Syme's Turnip Thinner.*—Manufactured by Messrs. Ord & Maddison, Ltd., Darlington. Price in April, 1922, £14.

Area thinned per day of 8 hours	4 acres.
Width of gaps	9 in.
Cost of thinning per acre	3s. 6d.
Weight of crop before topping and tailing	12·6 tons per acre.
" " after " "	7·3 " "

This machine is drawn by one horse led by a boy and requires a man to operate it. A revolving wheel or spinner is mounted at the rear of the machine and operates directly on the row by means of a series of ten blades shaped like hoes mounted on its circumference. This wheel is driven off a spindle geared to the main axle carrying the driving or land wheel: a hand clutch is provided for putting the spindle in or out of gear. The speed of the thinner can be varied to suit different soil conditions by using different gear-wheels. The depth at which it works can be adjusted by means of an overhead balance with spring counter-balance which the operator controls with a handle serving the double purpose of balancing and steering.

Under test the machine thinned the 2·7 acres in 4 hours 55 minutes, making gaps of about 9 inches between the roots. A spare wheel is provided with this machine with 8 hoes instead of 10; this leaves gaps of about 12 inches.

(2) *Parmiter Turnip Thinner.*—Manufactured by Messrs. P. J. Parmiter & Sons, Ltd., Tisbury, Wilts. Price in April, 1922, £18.

Area thinned per day of 8 hours	6·6 acres.
Width of gaps	12 to 15 in.
Cost of thinning per acre	2s. 5d.
Weight of crop before topping and tailing	14·3 tons per acre.
" " after " "	9·2 " "

The Parmiter is a double row machine. It has a main frame to which are attached ordinary shafts for horse traction. On the rear end of the frame two carrying spindles are mounted at an angle of about 45°, and have at their lower ends circular wheels, on the peripheries of which are mounted 12 plain hoe

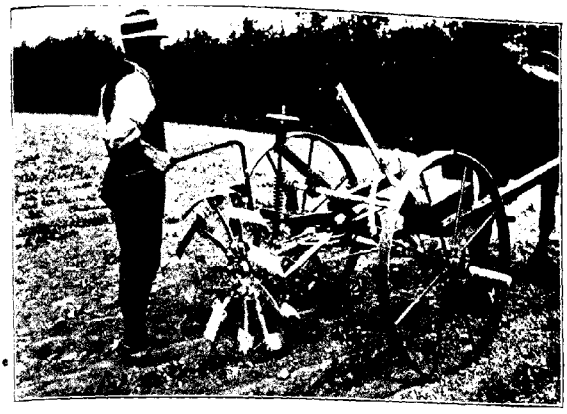

FIG. 1.—The Syme's Turnip Thinner.

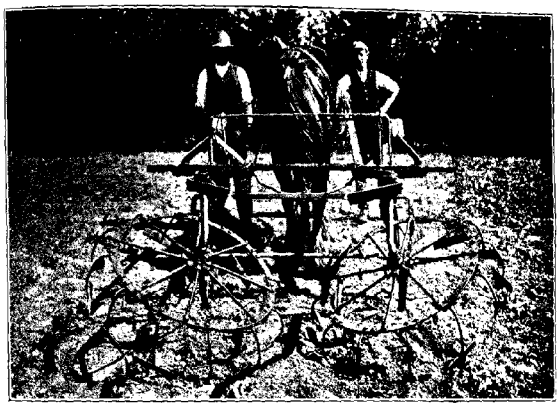

FIG. 2.—The Parmiter Turnip Thinner.

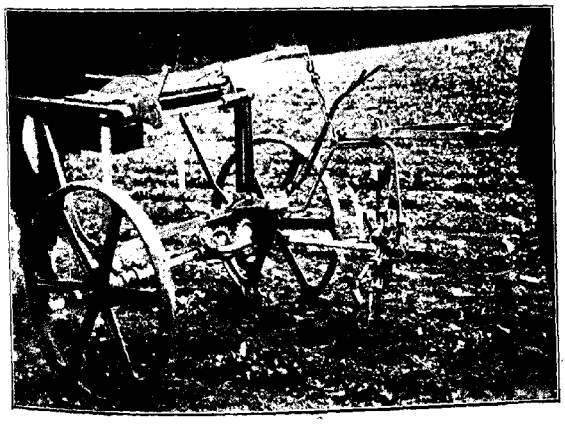

FIG. 3.—The Russell Turnip Thinner.

FIG. 4.—Portion of Plot gapped by Machine.

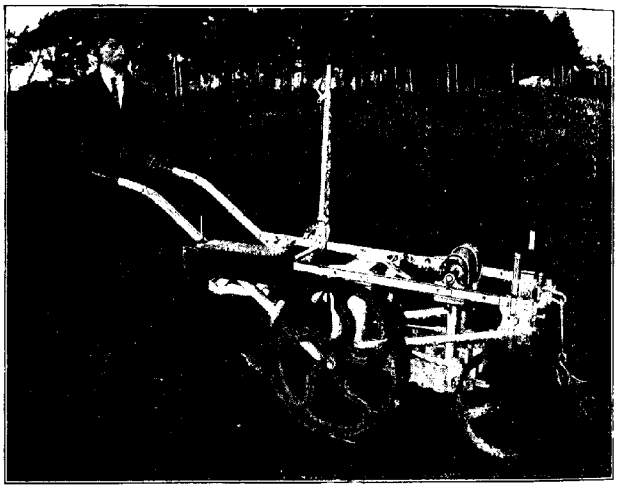

FIG. 5.—The Teasdale Topping and Tailing Machine.

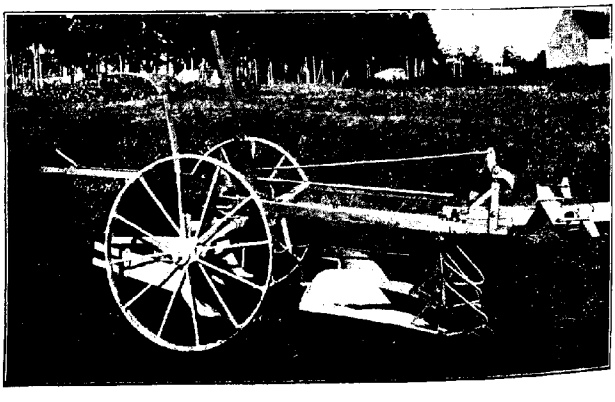

FIG. 6.—The Wigg's Topping and Tailing Machine.

blades at regular intervals. The forward motion of the machine when these blades are in contact with the ground rotates the gapping devices, which are counterbalanced by sliding weights. Handles are provided for the operator to control the digging and guiding action of the machine. A boy is required to lead the horse.

In the tests this machine made gaps in the rows of 12 to 15 inches. Being a double row machine it naturally showed a greater capacity than the other machines, thinning an area of 2·6 acres in 3 hours 10 minutes.

(3) *Russell Turnip Thinner.*—Manufactured by Messrs. The Maldon Iron Works, Maldon, Essex. Price in April, 1922, £14.

Area thinned per day of 8 hours	4 acres.
Width of gaps	10 in.
Cost of thinning per acre	3s. 10d.
Weight of crop before topping and tailing	17·3 tons per acre.
,, ,, after ,, ,,	10·6 ,, ,,

This machine thins a single row at a time, is drawn by one horse and requires a man and a boy to operate it. There are many features which render it adaptable to varying conditions but in the main it does not depart from the design of the Syme's. A spinner unit at the rear of the machine is driven from gears connected to the main axle. The spinner carries 8 hoes, the angles of which are adjustable. In addition the diameter of the wheel may be altered as desired. The shaft carrying the spinner wheel is actuated by bevel gears through a universal coupling which enables the spinner to be worked on either side of the operator. A hand clutch is provided for putting the spindle in and out of action. Alternative bevel gears may be fitted to vary the speed of the spinner wheel, which is counterbalanced by a spring. Handles are provided by means of which the operator controls the spinner.

The tests of the Russell machine were not commenced till late in the day and consequently it only worked for 2 hours 42 minutes, during which time it thinned 1·4 acres.

(4) *Hand Labour.*—4 men.

Area of turnips thinned per day of 8 hours	3·9 acres.
Width of gaps	8 in.
Cost of thinning per acre	5s. 1d.
Weight of crop before topping and tailing	13·7 tons per acre.
,, ,, after ,, ,,	7·9 ,, ,,

The men used ordinary hand hoes and worked extremely well.

Conclusions.—It will be seen that the machines were considerably cheaper and a little faster than the team of 4 men. With one exception, the yield proved greater where thinned by machine, though it should be noted that the machine-thinned turnips were on the whole of small size and growing in bunches.

The particular crop upon which the tests were carried out was grown for sheep folding, in which case the larger yield of the machine-thinned turnips was an advantage. The tests demonstrated the possibility of thinning or gapping turnips by mechanical devices at less cost and in less time than by hand labour with no loss in the total weight of the crop. It must be remembered, however, that the machines are not capable of singling the crop to be lifted.

Lifting, Topping and Tailing.—The lifting, topping and tailing of turnips by hand is a tedious and expensive process, and there is room for an efficient mechanical device for carrying out these operations cheaply and quickly. At present there

are very few topping and tailing machines on the market, and the Ministry was only able to secure the use of two machines for an investigation which was carried out on the experimental farm at Methwold in November, 1922. There are other machines in existence but they do not appear yet to have emerged from the experimental stage.

For the tests, three plots of swedes grown on the flat were selected. Each plot contained eight rows and represented an area of approximately $\frac{3}{4}$ acre. The rows were 370 yd. in length and 2 ft. apart, and the swedes were about 1 ft. apart in the rows.

Observations on the performance of each machine and summary of results:—

(1) *Teasdale's Turnip Topping and Tailing Machine.*—Manufactured by Messrs. Teasdale Bros., Ltd., Darlington. Price, £22.

Area dealt with per day of 8 hours	...	...	4.5 acres.
Percentage of turnips topped	...	...	77·5
„ „ tailed	...	...	100
Estimated cost per acre	...	...	5s. 3d.

The Teasdale is a two-horse machine drawn by means of an ordinary swingle tree. The main structure is mounted on four carrying wheels. The fore wheels are each mounted on to a vertical shaft which permits adjustment of the front unit to varying depths. The rear wheels are also independently adjustable, and are on separate spindles connected to the sides of the framework. The left wheel and spindle carry a driving sprocket connected to another sprocket which actuates two canvas rollers by intermediate gears. These rollers are mounted between the forward frames of the machine and run vertical and parallel to them, and grip the turnip tops whilst they are being cut by a V-shaped knife mounted underneath. The rear of the machine carries a hoe blade which runs underneath the drill and tails and lifts the roots after they have been topped. Adjustments are provided for the chain suspending the canvas roller, and for the movable bracket carrying the tailing hoe.

There was a tendency for the front guides to become choked with cut leaves, and it was also noticed that careful steering was necessary, in order to get the tops in the centre of the cutter, and ensure satisfactory working. In its present form the cutter had a tendency to ride over the swedes: it is possible that had the back of it been slightly heavier the topping would have been more efficient. The tops of the swedes were small so that the canvas gripping rollers were not working to the best advantage.

It was observed that under certain conditions the machine had a tendency to skid and it is suggested that this difficulty would be overcome and the machine materially improved by employing a chain drive from both wheels instead of from the left wheel only. A disc coulter was attached in front of the tailing hoe but this was removed in view of the light nature of the soil and the fact that it had a tendency to cut some of the roots.

(2) *Wigg's Turnip Lifting, Topping and Tailing Machine.*—Agents, Messrs. W. E. Wigg & Sons, Burnby Foundry, Beccles, Suffolk. Price, £23.

Area dealt with per day of 8 hours ...	9·7 acres
Percentage of turnips topped	65·7
„ „ tailed	Nil
Estimated cost per acre	2s. 6d.

This machine is drawn by two horses, but operates on two rows at once. The Wigg is of Danish origin and consists of two units, a front and a rear carriage connected together by a secondary frame. No complicated gearing is involved. The topping of the root is effected by means of V-shaped shoes fitted with guards. The bottom of each shoe rests on the drill top, the V being knife edges whose sides serve as guides to align the plant to the V-shaped cutter. The shoes are adjustable by means of chains suspended vertically from the frame. The tailing devices consist of hoes attached vertically to the main frame, which is adjustable by means of a lever on the secondary frame. Further means of adjustment were provided for steering off the swingle tree and also for adapting the two operating units.

Prior to the tests this machine had been operated by a representative of Messrs. Wigg on a portion of the test ground, and during the test every endeavour was made to make it tail the turnips, but it failed completely in this. This machine was not so difficult to steer as the Teasdale, as provision was made for the topping cutters to have greater play. These cutters, however, became choked with cut leaves and had to be cleaned frequently. In addition to its failure to tail the swedes effectively the Wigg occasionally failed to lift and expose the roots. It is thought that this was due to the back blades being too deeply set on the standard and being badly shaped. The blades did not appear to have sufficiently good cutting edges.

(3) *Hand Labour.*—Two men.

Area topped and tailed per day of 8 hours	1·2 acres
Percentage of turnips topped	100
„ „ tailed...	100
Estimated cost per acre	8s. 2d.

Conclusions.—The tests clearly demonstrated that economy in time and money may be effected by machines where a considerable area of roots have to be dealt with. The Teasdale machine performed work at a speed equal to nearly 8 men and at approximately five-eighths of the cost. As an offset to this economy is the expense necessary for topping the 24 per cent. missed by the machine, but it may be expected that further experiments on the part of the manufacturers would result in a still more efficient machine.

The Wigg machine failed to tail the turnips owing mainly to a poorly designed cutting hoe. That this defect could be remedied without difficulty is clear from the fact that Messrs. Teadale's tailing hoe performed satisfactorily. The machine topped the turnips fairly satisfactorily.

TABLE I.—TURNIP THINNING: GENERAL RESULTS.

Methwold, July, 1922. Soil: Light Sandy Loam.

Device or Method	Labour	Working Time	Acreage thinned.	Acreage thinned per day of 8 hours	Average number of roots per row in control plots.			Weight of crop in control plots expressed in tons per acre *		Total cost of thinning each plot, including capital charges for machines	Cost per Acre
					Before thinning	After thinning	When grown	Before topping and tailing	After topping and tailing		
		hr. mins.								s. d.	s. d.
Syme's ..	1 man 1 boy	4 55	2·7	4·0	236	74	67	12·6	7·3	9 7	3 6
Parmiter .	1 man 1 boy	3 10	2·6	6·6	207	101	98	14·3	9·2	6 4	2 5
Russell ..	1 man 1 boy	2 42	1·4	4·0	281	66	58	17·3	10·6	5 3	3 10
Hand labour	4 men	5 40	2·8	3·9	289	58	53	13·7	7·9	14 1	5 1

* This is the result after weighing control plots when the crop had grown.

TABLE II.—TURNIP LIFTING, TOPPING AND TAILING: GENERAL RESULTS.

Each plot was 370 yards in length (containing 8 rows of swedes) and having an area of 2/5th acre.

Methwold, November, 1922. Soil: Light Sandy Loam.

Device or Method	Number of men employed	Working Time	Average Time per row	Percentage topped	Percentage tailed	Acreage dealt with per day of 8 hours	Cost per Acre
		hrs. mins.	mins.				s. d.
Teasdale (single row) ...	1	44	5·5	77·5	100	4·5	5 3
Wigg (double row) ...	1	20·5	2·6	65·7		9·7	2 6
Hand Labour	2	5 20	20·0	100	100	1·2	8 2

The results so far obtained, although based upon so restricted a field, which is far from covering the possible mechanical methods of dealing with the problems involved, indicate that the prospects of efficient machinery for lifting, topping and tailing the root crop are reasonably good.

It is worthy of mention that no greater damage was caused to the roots by the machines than by hand labour, and such faults as have been revealed in the test would doubtless be eliminated by further experiment.

It appears that the greatest possibility of future development lies in the direction of the double or multi-row machines; but further experiments with other types of land and conditions of growing must be carried out before adequate data will become available for any decision as to the most promising line of development.

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DUTCH BARNS AND COVERED YARDS.

MAJOR H. P. G. MAULE, D.S.O., M.C., F.R.I.B.A., and A. EWART ASTON,
Ministry of Agriculture and Fisheries.

IN former articles reference has frequently been made to the difficulty of producing modern farm buildings at a sufficiently low capital expenditure to give an economic return, and it has been pointed out that the great need at the present time is to evolve simple and cheap forms of construction whereby improved accommodation and greater economy of labour can be effected. There can be little doubt for instance that the need is very great for cheap Dutch Barns and covered yards, and if such could be erected to produce an economic return on capital outlay considerable benefits would result.

One of the reasons for the high initial cost of farm buildings has been the conservatism of the English character, and the dislike to put up buildings other than in the most substantial and durable manner. A considerable part of the cost has been caused by a blind adherence to the use of the heavy framed timber truss roofs, even for quite small spans. Such methods are both wasteful in material and costly in labour, for carpenter's joints need skill and care in execution, and heavy timber scantlings cost more in proportion than light ones.

The evolution of timber framed trusses is, comparatively speaking, simple and has proceeded along the lines of large single tie beams and heavy scantlings framed into trusses, carrying heavy purlins and distributing the weight at isolated points of support. The use of heavy tiles and slates, as a roof covering, has necessitated considerable strength, and virtually, until quite recent years, there has been little or no development in new roof type forms, save by the substitution of iron and steel truss roofs, produced by big manufacturers, which require special skill in erection and considerable expenditure in maintenance. While there is no question as to the efficiency of these last-mentioned buildings, the cost and difficulty of erection, involving as it does the expense of transport both of skilled workmen and materials, has been a deterrent from their general use by tenant farmers or small holders, and even on large farms the abnormal cost of such buildings in recent years has made their economic erection an impossibility.

There is, however, a simple remedy. New forms of construction have been evolved based on three simple factors: the almost exclusive use of light timber scantlings so arranged that the erection is a simple matter for local unskilled labour: the use of creosote both as a preservative and means of reducing annual expenditure in maintenance; and the use of modern light covering materials such as galvanised iron, asbestos sheets, Trafford tiles, or Yorkshire spaced boarding as in the case of covered yards.

The solution is, in fact, a new and improved type of construction, which does not need elaborate carpenter's joints, heavy scantlings or greatly skilled labour, combined with a judicious use of new materials, and which, therefore, by lowered capital cost reduces the problem to the simple one of balancing capital outlay against improved economic results and a definite reduction in annual outgoings.

In the case of Dutch Barns, it is obvious that if a given area can be roofed in for a capital outlay which is more than met in a limited number of years by the saving on the annual thatching of an equal area of hay or corn crop, the advantages of the permanent roof, ready at all times and seasons, must result in improved profits and diminished risk of loss by inclement weather or bad seasons. The case of covered yards is, perhaps, more difficult to show in figures, but the expert agriculturist should have no difficulty in satisfying himself whether interest and sinking fund on his capital outlay will not

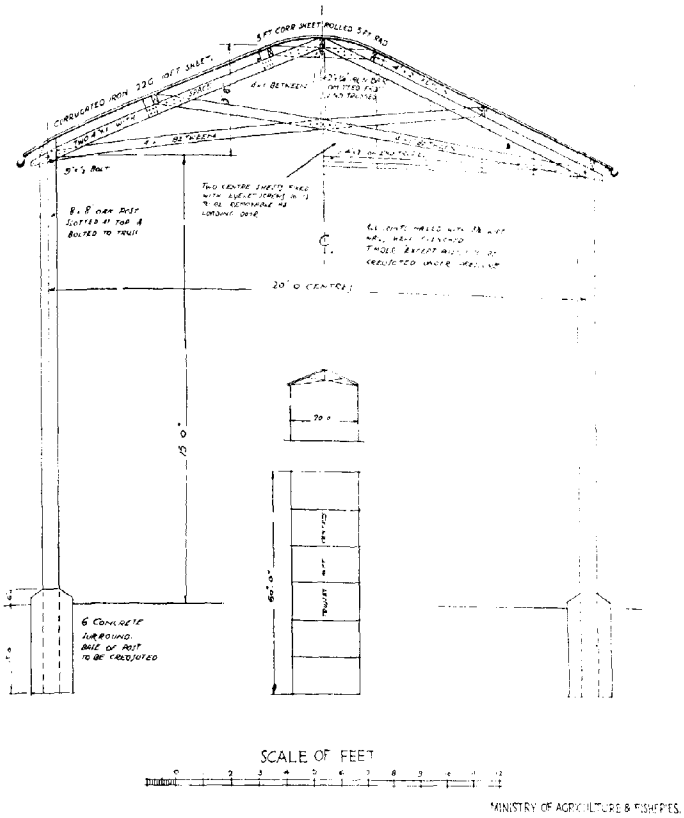

FIG. 1.—Design for Timber Dutch Barn.

FIG. 2.—Dutch Barn (on right) erected at Papplewick Hall, Notts.

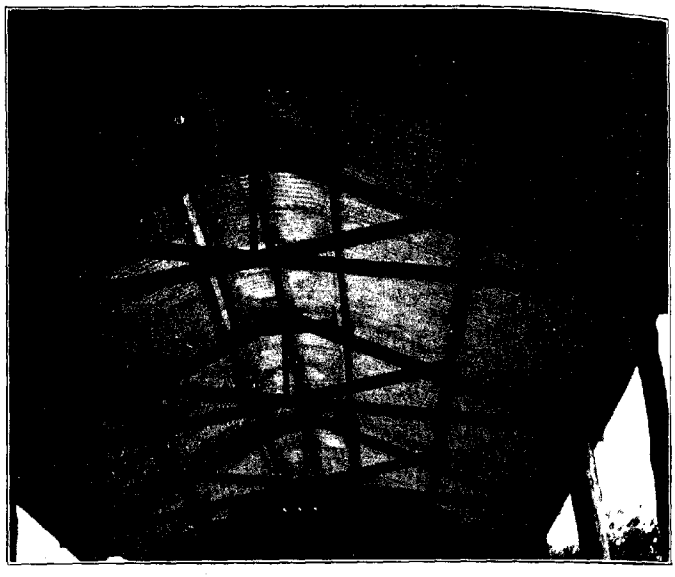

FIG. 3.—Dutch Barn at Papplewick Hall, Notts. Inside of Roof, showing trusses.

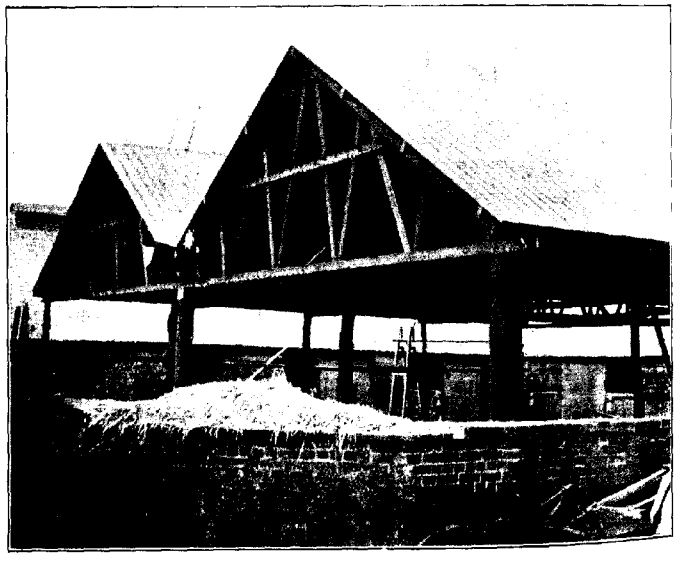

FIG. 4.—Covered Yard erected in Nottinghamshire.

be amply secured by the improved quality of his farmyard manure, reduced straw consumption and the greater head of stock he is enabled to carry.

The method advocated is in fact a return to the use of local materials wherever possible, home grown timber, when such can be readily obtained and converted, and such a simple method of construction that the village carpenters can, under adequate supervision, do all that is necessary. The principles here illustrated and described are in effect those which have been already advocated in former articles, particularly in the article published in this *Journal* for July last (The Planning and Construction of Cowsheds), to which reference may be made for further illustration of the use of small scantling timber in farm buildings.

The Dutch Barn of which a design is shown in Fig. 1 is intended to embody the principles enunciated above, and is, therefore, composed of materials easily obtainable locally, for even the galvanised iron used for roof covering can be procured in the smallest country towns. It will be seen that very light timbers are used for the trusses, only 4 in. by 1 in. in fact, not only to save in cost of material, but also to facilitate handling and erection. The necessary strength is obtained by making the rafters of two pieces of 4 in. by 1 in. and the cross ties and supports for the purlins are placed between them sandwich fashion, nailed and clenched. The trusses are best set out one on top of the other on the ground and erected either by first setting the posts in position and afterwards hoisting each truss and dropping it into the slots at the head of each post or, preferably, by fixing the truss to the posts when lying on the ground, tipping up into position and filling in round the feet of the posts.

The price of the barn as shown, 60 ft. by 20 ft., has been quoted at £110 made and erected, which works out at about 16s. 6d. per square yard covered. To thatch an equivalent area of hay or straw would require at least 20 squares of thatch, the cost of which may be counted as an annual charge entirely eliminated.

Figs. 2 and 3 are photographs of a barn of this design erected at Papplewick Hall, Notts, in the summer of 1922. Owing to want of space the span was made only 18 ft., and the posts were young oak trees cut on the estate. The cost in this case for all labour and materials (including a quotation for pitch pine posts) was just under £70 or under 11s. 8d. per square yard covered.

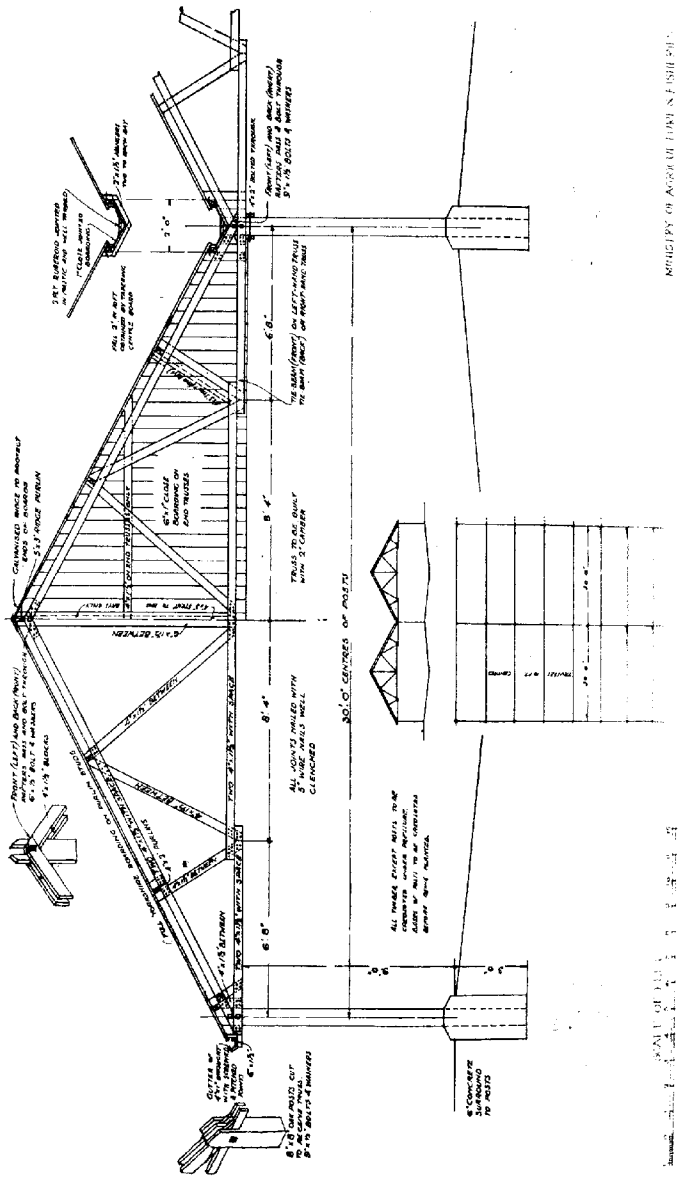

Fig. 5. Design for Eight Timber Covered Yard.

Fig. 5 is a design for a covered yard adopting the same principles of light construction. The posts are of 8 in. by 8 in. oak, the trusses built up from 4 in. by 1½ in., double for rafters and tie beams and single for the members between, with 4 in. by 2 in. purlins, to carry the space boarding. The method of trussing is the same, viz., the single members are "sandwiched" between the double members and spiked. The weight of one of these trusses is under 3 cwt. so that handling is much more simple than it would be with a solid truss for this span.

Prices have been obtained within the last two months for covered yards very similar to this and they vary from 11s. to 15s. per square yard of ground covered.

Fig. 4 is a photograph of a covered yard in Nottinghamshire composed of two spans of 26 ft. 6 in., the length being about 45 ft. in four bays. The cost of this, exclusive of the posts, but including the cutting and fixing of them, was £147 or about 11s. 1d. per square yard of cover. All the timber was treated with creosote under pressure—except the posts, which were cut on the estate. The trusses are built of 4 in. by 1½ in. with rafters and tie-beams double and other members single. (The middle horizontal piece is only there for fixing the end boarding, and is omitted from other trusses.) The purlins are 5 in. by 2½ in. and the boarding 1 in. grooved space boarding.

It is an undoubted fact that this light framed construction is much cheaper than the usual solid construction used for barns and covered yards and of course much more economical than steel. Not only is the total weight of timber less but smaller scantlings are invariably cheaper than the larger ones. Again, the old roofs with their solid timbers and "joiner's joints" need labour of considerable skill, whereas semi-skilled labour with careful supervision has been found quite sufficient for such buildings as are here shown. Often has it been found that the joints in old roofs have been pulled apart by the very weight of the timbers themselves, whereas by sandwiching the members as shown the strengths of the joints more nearly approximate to the strengths of the timbers themselves.

A word as to coverings. The Dutch Barn has been roofed with galvanised corrugated iron, which has a reasonably long life except near factory towns; it can be painted or tarred after a few years if desired. In any case it is well worth while to tar the laps when laying the sheets.

Space boarding at the angle of 30 degrees has been found satisfactory in places of average rainfall, but where this is

excessive or where there is much snow the pitch should be steeper. Boarding covered with ruberoid and tarred would be quite weather-proof, but would be greater in initial cost and also in maintenance; it is generally considered that a space boarded roof renders the buildings much fresher and healthier for the beasts.

Yorkshire space boarding is made generally of two types: (1) with narrow deep grooves, and (2) with broad shallow grooves. The latter are to be preferred as the boards are stronger and they appear to carry off the water in as satisfactory a manner as the others.

The purlin studs are for the purpose of keeping an air space between the underside of the boards and the purlins. If the boards are nailed down close, moisture is retained at this point and may cause decay in the purlins or boards.

It is claimed that buildings of this description would have a sufficiently long life to more than justify their erection, and that they will adequately meet the purposes required. On many estates the whole of the timber could be obtained, and the judicious use of creosote, even if only brushed on, would reduce the cost of annual maintenance to a minimum.

The number of inquiries which have reached the Ministry recently with regard to economical farm building assured the writers that there is a very considerable demand for information and practical advice, and it is hoped that these illustrations and descriptions may be of use, if for nothing else than indicating the lines upon which further developments may take place.

* * * * * *

FARM CAPITAL AND PROFITS.

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THE system of tenant farming which is typical of English agriculture is virtually a partnership of three interests, the landlord, the farmer, and the labourer. It is not, however, an equal partnership. The landlord contributes the capital value of the land; the labourer gives his services, while the farmer has two shares in that he provides the working capital and gives his time either in actual labour or in management—or both.

Any return which the farmer receives from his farm can accordingly be regarded as partly payment for his work and partly payment for the use of his capital. Our study of farm accounts in the Economics Branch of the Department of Agriculture in Leeds University has shown that the final result of any year's working is influenced to a certain extent by the capital at the farmer's disposal, but to a greater extent by the way in which that capital is distributed and the use that is made of it. At the present time, when the economic returns from farming are so disappointing, a review of one of the factors responsible for success or failure appears opportune.

The Extent of Farm Capital.—For the financial year 1921-1922, 38 accounts of Yorkshire farms have been completed and these show that on the 9,308 acres covered, the total capital invested amounts to £153,346, which is equivalent to an average capitalisation of £16 9s. 6d. per acre. Even on the relatively small number of farms concerned the variations in capital per acre are so great that too much importance cannot be attached to this average. It is, however, interesting to note as an illustration of the magnitude of the industry that, on this basis, the agriculture of England and Wales absorbs more than three hundred millions sterling.

TABLE 1.

Variations of Capital with Size of Farm: Averages of 38 Yorkshire Farms.

Size of Farm	Average Closing Valuations per acre, 1921-22.											
	Live stock			Tenant Right			Produce			Implements			Total		
acres	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
0- 50	15	11	5	5	12	1	2	5	10	5	13	4	29	2	8
50-100	7	1	4	4	17	11	2	7	9	3	16	1	18	3	1
100-150	7	16	3	4	3	0	2	18	7	2	17	2	17	15	0
150-200	6	18	0	3	5	7	2	12	4	3	10	7	16	6	6
200-250	7	13	0	2	12	8	2	15	3	3	18	9	16	19	8
250-300	5	15	11	1	19	11	1	7	7	1	14	11	10	18	4
Over 300	7	4	7	4	4	11	2	10	9	2	19	3	16	19	6

A glance at Table 1, in which the capital per acre on farms of various sizes is shown, brings out clearly the high capitalisation of small holdings. Up to the group 200-250 an increase in acreage of the farm is accompanied by a decrease in the capital per acre. The farms in the next group (250-300 acres) are mainly feeding farms and their low capitalisation is

due to understocking in anticipation of a slump in prices. Had they been fully stocked with beasts a more normal figure would have been obtained, and the relation between size of holding and capital invested per acre would have been roughly in inverse proportion.

Capital Essential for Success.—The most successful of these 38 farms was very highly capitalised, having nearly £26 invested per acre. Another farm with even more money per acre made a substantial loss. Of the 18 farms whose capital was above the average, 61 per cent. sustained losses, while of the remaining 20 with capital below the average, 55 per cent. failed to pay their way.

TABLE 2.

Relation of Total Capital to Profit or Loss.

Farm	*Capital per acre*	*Profit*	*Loss*
P.	£26	53%	—
G.	£25	—	35%
M.	£18	8%	—
E.	£17	—	24%
W.	£15	8%	—
A.	£13	—	25%

In Table 2 figures are shown of farms with high, average, and low valuations. There is a fairly close agreement in the capital per acre of the two examples in each group, yet the results shown in the next columns as profits or losses expressed in terms of the capital invested do not similarly correspond. It would seem that there is no definite relation between the total capital employed and the profit or loss, always providing that the amount available is sufficient to meet the needs of the farming system adopted.

The Disposition of Farm Capital.—To secure a uniform basis for comparison, the total capital of each farm has been divided under four headings, namely: (1) Live stock; (2) Tenant Right; (3) Produce; (4) Implements. Of these terms only one requires amplification, the other three being self-explanatory. Under the term "Produce" is included all crops on hand whether for feeding or for sale, all foods and manures purchased and not yet used, and all expendable stores such as binder-twine, oil and veterinary preparations. The following table shows in what proportions the capital of the 38 farms was disposed.

TABLE 3.

Disposition of Capital at Closing Valuation, 1921-1922.
38 Yorkshire Farms comprising 9,308 acres.

	Total £	*Per Acre* £ s. d.	*Percentage of Total*
Livestock	66,964	... 7 3 11	... 44
Tenant Right ...	35,622	... 3 16 7	... 23
Produce	22,829	... 2 9 0	... 15
Implements	27,931	... 3 0 0	... 18
Total	153,346	... 16 9 6	... 100

The significance of this analysis lies in the fact that it shows at a glance what a burden of unproductive capital the industry has to carry. The capital invested in live stock and tenant right can be regarded as in circulation. When live stock or animal products such as milk and wool are sold, the capital invested under this heading is turned over. Similarly crops sold or fed are the proceeds of the labour, seed and manure included under the term "Tenant Right," the money invested in which is accordingly being turned over. Produce and implements, however, represent money lying idle. The one may be regarded as raw material waiting to be manufactured (such as manures and foodstuffs) or as manufactured foods waiting to be sold (such as crops harvested): the other is dead stock on which no profit is expected and the depreciation of which is regarded as a charge against profits. From Table 3 it will be seen that in this sense only 67 per cent. of the total capital is in circulation on these farms, the remainder lying idle in the form of implements and produce.

TABLE 4.

Influence of Capital in Circulation on Profits.

Farm	*Percentage Capital in circulation*	*Profits as percentage of Capital*
D.	74 ...	... 12
I.	80 ...	... 15
		Loss as percentage of Capital
G.	49 ...	... 35
C.	56 ...	... 31

As it is only on the capital in circulation—that is on the money turned over—that profits can be made, the importance of having as large a sum as possible so invested is obvious. The point is strikingly brought out in Table 4, a comparison of the returns from farms where more than the average capital is in circulation with those from others where less is so invested.

As an example of a bad disposition of capital the following quotation from a report sent to one farmer on his accounts for 1921-1922, is instructive :—

> "The total capital invested in the farm on 31st December, 1921, amounted to £4,936 18s. 6d. or £25 9s. 3d. per acre. When, in the valuation, account has been taken of the falling value of stock, it would appear that the farm is suffering to a small extent from over-capitalisation, and to a large extent from not having the capital laid out to the best advantage. The summary of the farm valuation shows that 37·7 per cent. of the capital was invested in live stock, 11·4 per cent. in tenant right, 39·4 per cent. in implements, and 11·5 per cent. in produce. The money invested in live stock and tenant right may be looked upon as capital in circulation, that invested in implements and produce as capital to a large extent lying idle. In this case more than half of the capital is invested in dead stock, whereas if a farm is to be run at the present time on economic lines, at least 70 and if possible 75 per cent. of the capital must be put into circulation."

It has previously been noted that small holdings have a higher total capital per acre than larger farms, and it is interesting to see if this increased amount is invested where it can be used or if it is locked up in an unproductive form. Table 1 shows that the true small holdings have nearly as much money per acre invested in live stock as the farms above 100 acres have in all the divisions of the valuation. The tenant right is also higher per acre than in any other group. Produce is about the average, but the amount invested in implements shows up the weakness of the small holding. (What co-operation could do in this respect is beyond the scope of this article, but the facts presented are certainly suggestive.)

When, as is shown in Table 5, the figures of Table 1 are expressed for each group as a percentage of the total average capital per acre, several other points are brought out.

TABLE 5.

Disposition of Farm Capital on Holdings of Various Size (Expenditure as Percentage of Total Capital).

Size of Farms in acres	*Percentage of Total Capital Invested in*			
	Live stock	*Tenant Right*	*Produce*	*Implements*
0– 50	53	19	8	20
50–100	39	27	13	21
100–150	44	23	17	16
150–200	42	20	16	22
200–250	46	15	16	23
250–300	53	19	13	15
Over 300	43	25	15	17

The figures justify the high capitalisation of small holdings, for in this group (0-50 acres) the percentage capital in circulation exceeds that in all other groups with the exception of the 250-300 acre farms previously mentioned. The small percentage of the small holders' capital invested in produce is difficult to explain, but two facts brought out in our dealings with this class of farmer are suggestive : (1) purchases are usually made in small amounts, and (2) although the buildings on these small farms usually provide adequate accommodation for stock, granaries and sheds for the storage of produce are often conspicuous by their absence. If these factors are responsible for the result noted, it would appear that the lack of storage facilities is from this point of view a blessing in disguise, preventing as it does the sinking of money in unproductive assets.

In the remaining groups the figures show a sufficiently close agreement both among themselves and with the average for all the farms (Table 1). With the exception of the 250-300 acre group the differences are so small that they can be accounted for on the basis of purely local conditions.

Capital Turnover.—When once a farm is sufficiently capitalised and when that capital has been advantageously disposed, as described in previous sections, the farmer has the best chance of success. One of the remaining factors which influences his profit or loss is what he *does* with his capital. On the 38 farms the total income for the year 1921-1922 was £159,041, or 104 per cent. of the total capital, or 155 per cent. of the capital in circulation. This turnover was insufficient to provide a profit when the results of all the farms are considered together, owing to the large depreciation which had to be allowed for in the year's accounts.

In an ordinary year it might be said that there is a reasonable chance of success if 80 per cent. of the total capital of a

TABLE 6.

Influence of Capital Turnover on Profits.

Farm	*Percentage Capital Turned over*	*Profits per acre* £ s. d.	*Loss per acre* £ s. d.
Average	104	—	1 2 9
P.	220	13 17 8	—
H.	180	1 2 2	—
C.	48	—	7 13 9
M.	49	—	3 5 7

mixed farm is turned over each year, and if not less than 120 per cent. be turned over on a dairy farm.

Table 6 shows the results obtained last year on two farms with a turnover higher than the average, and on two others where the turnover is less.

Although the difference in the economic returns on these farms cannot be attributed entirely to the differences in turnover, these latter were no doubt partly responsible. In writing to M. on the results of his year's working, it was pointed out that:—

> "Owing to the small turnover and in order to make a profit equal to double the rental, everything must have been sold so as to leave a net profit of 50 per cent. *Meadow Hay* produced at a cost of £6 14s. 3d. per ton must have been sold at £10 1s. 0d. per ton; *Potatoes* costing £3 2s. 7d. per ton must have been sold at £4 14s. 0d. per ton; *Wheat* costing £3 18s. 8d. per qr. to produce must have sold at £5 18s. 0d. per qr.; *Barley* produced at £2 8s. 0d. per qr. must have been sold at £3 12s. 0d. per qr.; *Oats* produced at £1 10s. 9d. per qr. must have been sold at £2 5s. 9d. per qr. The *Pigs* killed on the premises must have been charged to the house not at £16 6s. 0d. but at £21 1s. 3d. each. The 30 *White Faced Hoggs* bought for £90 and maintained at a cost of £19 1s. 6d. should have been sold before Christmas for £5 9s. 0d. apiece.
>
> "At the present time these prices are unobtainable, and the only available method of increasing the returns is by increasing the output."

The Influence of the War and the Recent Slump.—An examination of the annual variations in the capital per acre invested on one farm from 1914 to 1922 shows that following a slight decrease in 1915 a gradual appreciation in values took place until 1918, when a sharp rise is noted. The appreciation continued to 1921, and during the last year a sharp decline was felt. This decline continued, though probably in a less degree, during 1922. From the fact that in 1922 over £20 per acre was invested it will be seen that this farm was highly capitalised, but this was necessarily so, owing to its nature. The curve, however, may be taken as indicative of the variations which have occurred during the period under review.

An outstanding case of the effect of the slump has recently come to our notice. A farmer who commenced farming in 1918, when values were at their highest point, had £2,500 of his own capital and borrowed £2,500 from other sources. Part of this sum has recently been called in and as the farmer was unable to raise the money his affairs have been put into the hands of the Official Receiver. A valuation has accordingly been made, the details of which are given below and compared with the same items on entry in 1918.

On the three items mentioned this farmer has lost over £2,500, which is equivalent to 58 per cent. of the capital originally invested under these headings, and is more than the whole of

The Effect of the recent Slump on Farm Capital.

	Valuation in April, 1918	*Valuation in Nov., 1922*	*Decrease*
Tenant Right	£2,160	£970	£1,190
Horses	973	275	698
Implements	1,231	600	631
Total	4,364	1,845	2,519

the capital he put into the business in 1918. Had there been no necessity to repay part of the loan or had he been able to raise another loan there is every indication that this farmer would have been able to weather the storm. This, and numerous other cases which have recently been investigated, all point to the inadequacy of the present facilities for the provision of short-term loans.

The Effect of Purchasing a Farm.—That farmers have in recent years been purchasing their holdings is a fact which is frequently brought up as evidence of the prosperity of the industry. An investigation of the facts of the case in Yorkshire has been undertaken, and some of the economic results are here presented.

Of 52 farms whose accounts are now kept by the department of agriculture of Leeds University, only 7 were owned by the occupier before 1918. Since that date 13 others have been purchased, and the total area now farmed by the owners is 6,358 acres or 49 per cent. of the whole land costed.

Full details were obtained from nine of the thirteen farms recently purchased, and similar facts relating to four other farms, whose accounts we do not supervise, were also available. From these farms, comprising 3,164 acres, it would appear that the farmers concerned have had to find £92,905 which is the total purchase price of the acreage mentioned. This gives an average purchase price of £29 7s. 3d. per acre. How this sum has been raised is shown by the following facts:—(1) the average sum paid off amounts to £10 1s. 8d. per acre; (2) the average sum on mortgage is £12 15s. 4d. per acre; (3) the average sum as Bank Overdraft £6 7s. 1d. per acre; and (4) the average sum as other loans is 3s. 2d. per acre. Only 35 per cent. of the purchase price has accordingly been paid off, the remaining 65 per cent. being raised as loans of one kind or another. The average rent on these 3,164 acres

previous to purchase was £1 7s. 6d. per acre. The present annual charges, allowing 5 per cent. on the amounts paid off and charging actual rates on overdrafts and mortgages (approximately 5¼ and 6¼ per cent. respectively), amount to £1 16s. 3d. per acre. This sum includes tithe and land tax but makes no allowance for repairs. The purchase of the farms has thus increased the annual charges by 8s. 9d. per acre.

The paying off of even the small proportion of the purchase money previously mentioned has seriously hampered the tenants in many cases. Two tenants, when faced with the necessity of purchasing their farms, had to move to smaller farms than those they were farming as tenants. One took in a partner and used the extra capital so obtained for his deposit. Another, a dairy farmer on a small holding, reduced his herd from 19 to 12 cows. Several obtained fresh capital by the realisation of other securities, while one in paying a deposit so reduced the working capital that a second mortgage had to be arranged.

In conclusion, the various points brought out may be summarised as follows:—

(a) On 38 farms of 9,308 acres the capital invested per acre was £16 9s. 6d. Provided sufficient capital is available for the system of farming adopted, the total sum appears to have little effect on the economic returns of the holding.

(b) Of the total capital on any farm at least 70 per cent. should be in circulation.

(c) With sufficient capital at his disposal and with this advantageously disposed, the next point to consider is the capital turnover. If on a mixed farm at least 80 per cent. and on a dairy farm 120 per cent. of the capital be turned over each year, the farm stands a chance of success.

(d) The recent slump in agricultural prices has so reduced the working capital of many farmers that the provision of short-term credits appears necessary.

(e) In the case of thirteen farms recently purchased only 35 per cent. of the purchase price has been paid, and the total annual charges on the land are now 8s. 9d. more per acre than the previous rent.

* * * * * *

THE FEEDING VALUE OF OAT STRAW.

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McCOLLUM in America* has shown that cows and their calves can be raised to perfection on the complete maize plant alone, although maize grain is well known as a very incomplete food, and that straw is the most likely thing in the world to correct for deficiencies of grain feeding. The difficulty is to obtain straw that is eatable.

The experiments on the feeding value of oat straw which were begun at Armstrong College, Newcastle-upon-Tyne, in a tentative manner some years ago,† have, since October, 1920, been carried out more extensively, thanks to a special grant from the Ministry of Agriculture. The 1920 and 1922 crops were much damaged by wet weather, but the three years' experiments have, nevertheless, helped to determine those differences in feeding value which naturally occur in oat straw, and those conditions which are needed to obtain a high feeding value. The experiments also indicated a reason why farmers in some districts can feed cattle on swedes and straw, whilst in others they find it impracticable to do without some concentrated food.

The first subject investigated was the sugar content, but it was found during the progress of the investigations that the albuminoids appeared equally important. The chief digestible carbohydrate of oat grain is starch, which on digestion yields the same sugar as that which occurs in turnips, yet the sugars found in the straw are very similar to those found in honey,‡ and confer a high degree of sweetness on the straw. Samples of oat straw from many parts of Great Britain have been examined for their chief constituents, and as far as possible the conditions in which the straw was grown have been recorded. The investigations of the nitrogenous matter showed that the proportion of non-albuminoid nitrogenous matter was so small that all the nitrogenous matter in straw may be considered as of a high feeding class, in contra-distinc-

* McCollum: *The Newer Knowledge of Nutrition* (Macmillan), pp. 100.

† Collins & Spiller: Sugar in Oat Straw and Cattle Food, *Jour. Soc. Chem. Ind.*, 1920, p. 66. T.

‡ Collins: The Estimation of Lævulose (Fructose) in Straw, *Jour. Soc. Chem. Ind.*, 1922, p. 56. T.

tion to swedes, in which much of the nitrogenous matter is of doubtful feeding value.

Effect of Manure on the Composition of Oat Straw.—By dividing the results of the analysis of oat straw into three groups, the following comparative quantities are found (unless otherwise stated the results are calculated from the 1919, 1920 and 1921 crops*) :—

35 samples of oat straw grown on soil containing very much organic nitrogen, such as may have been derived from old grass ploughed in, omitting doubtful clover takes, but including land which had received heavy dressings of farmyard manure :

Lævulose or honey sugar	1·0 per cent.
Total sugar	2·5 „ „
Albuminoids	3·8 „ „

29 samples of oat straw which had been top-dressed with sulphate of ammonia, usually about 1 or 1½ cwt. per acre, but otherwise poorly manured :

Lævulose or honey sugar	1·6 per cent.
Total sugar	3·3 „ „
Albuminoids	2·5 „ „

21 samples of oat straw grown with little, if any, nitrogenous manure in any form :

Lævulose or honey sugar	1·6 per cent.
Total sugar	3·5 „ „
Albuminoids	2·6 „ „

The combinations of these results which give significant differences are :—Much organic nitrogen gives an oat straw richer in albuminoids than that given by little or no nitrogen to the extent of 1.27 per cent., as judged by 56 tests. Much organic nitrogen gives an oat straw richer in albuminoids than that given by sulphate of ammonia top dressings to the extent of 1.30, as judged by 64 tests. Organic nitrogen manures give oat straw richer in albuminoids than that given by all other systems of manuring, to the extent of 1.28 per cent. as judged by 85 tests.

Other probable but less certain results are :—(1) organic nitrogen manures depress the amount of lævulose in oat straw, and (2) sulphate of ammonia is better than organic nitrogen for sugar production. Both of these two last results only refer to small differences of about 0.5 per cent.

The general conclusion, on the effect of manure on the composition of oat straw is, that ploughing in old lea with a good clover take, or applying much farmyard manure, results in

* Collins & Thomas : The Sugar and Albuminoids of Oat Straw, *Jour. Agric. Sci.*, 1922, p. 280.

producing an oat crop, the straw of which will be so much richer in albuminoids or flesh formers, that 13 cwt. will go as far as a ton of straw grown on poorly treated land, but as regards sugar content the proportion is the other way about. Nitrogenous dressings applied to the land, or feedings given to the beasts in the byre, tend to raise the fertility of the farm, and their effects are cumulative, whereas the value of sugar goes away with the beasts to market.

Effect of the Different Districts on the Composition of Oat Straw.—It was possible to select only a few farms to represent large areas, and the names of the districts must not be taken too literally. In some cases personal knowledge permitted the farms to be fairly well scattered, so that county Durham is fairly well represented, but the name of Scotland simply refers to the average of results from a few places well to the north of Northumberland. Yorkshire is represented almost entirely by the Garforth Experimental Farm, only a few other places in the county being among the list of farms from which samples were obtained. The Southern Counties district is more widespread, since it includes Derby, Notts, Essex, Herts, Bucks, Hants and Wilts, and may fairly be considered to represent "the South" from a North-countryman's point of view. In spite of these drawbacks in the classification, the following useful comparisons may be made:—

Albuminoids in Oat Straw in Different Districts.

Scotland with 20 samples gives 3·2 per cent. of albuminoids.
Northumberland and Durham with 26 samples give 3·2 per cent. of albuminoids.
Cumberland and Westmorland with 15 samples give 4·4 per cent. of albuminoids.
Yorkshire with 27 samples gives 3·1 per cent. of albuminoids.
Southern Counties with 34 samples give 2·7 per cent. of albuminoids.

A striking result is the much higher amount of albuminoids in Cumberland and Westmorland. Oats are a very important crop in those counties, and receive more manure than is customary in other parts of the country. They frequently follow old leas and often receive much direct application of dung. If we put Cumberland and Westmorland aside and compare the other districts there is at once the striking result that albuminoids increase as one travels northwards. The difference between the Scottish figure and the figures from the Southern Counties is marked and is quite in accordance with the popular impression that straw can be fed to beasts in Scotland in a

way in which it could not be fed in the South of England. At Cockle Park one experiment with different dates of sowing seed showed that the total nitrogen in the crop per acre was similar in amount; with autumn-sown oats the large crop of grain took nearly all the nitrogen but the spring-sown oats gave only half the grain yield and left straw which was very rich in albuminoids. It follows that in Scotland with its short growing season the grain will not be able to exhaust the straw to the same extent as it would in England and that therefore Scottish oat straw will on the average contain more albuminoids than English oat straw.

A partial answer is given above to the well-known question:—Why can cattle be fed on straw and roots in Scotland and in the North of England but not in the South of England? It may be due to the superiority in albuminoids of north country straw. It is very possible that along with the albuminoids will also occur those little understood food accessory substances which are sometimes called vitamines. Swedes and turnips are very poor in albuminoids and the superiority of northern straw in this respect may be the determining factor in feeding stock. At Cockle Park in feeding trials on hay the determining factor is often the percentage of albuminoids. North country hay is poor in albuminoids, whereas north country oat straw is relatively rich. These facts go a long way to explain the different practices in feeding cattle, since, in the northern counties hay has a lower value and oat straw a higher value than in the south.

The variation in the albuminoids in oat straw grown in different districts may be partly due to rainfall. In Scotland, Northumberland, Durham and Yorkshire, the average rainfall at the places where the oats were grown was about 30 in., but the Cumberland and Westmorland areas have an average rainfall of about 45 in., and the Southern Counties area of about 27 in. Among other causes of high proportions of albuminoids may therefore be placed a good supply of water. Oats that are cut green may be cut green because the season is wet, with the result that the straw contains more albuminoids, hence the cattle relish the straw and the farmer says that the straw is sweet, but it is rich in albuminoids and not particularly rich in sugar. Succulent green food is usually richer in albuminoids than old and stalky fodder.

The District in which Oats are grown and the amount of Sugar in the Straw.—Seasonal influence plays such a great part

in sugar production and content that 1920 and 1921 do not give the same results. In 1920 Cumberland and Westmorland headed the list, Northumberland and Durham being only a little behind; but in 1921 the Southern Counties gave much higher amounts of sugar than the Northern Counties. From these results it is clear that the Southern Counties made good use of the dry season of 1921.

General Conclusions.—Fine weather during harvest appears to be essential for obtaining high percentages of sugar. Sugar gradually disappears from the straw after harvest. When straw is very dry, loss is small; but when damp the sugar is quickly lost. Under average conditions high sugar content is not common, but, under careful management, six months' old straw has been found very rich in sugar. Variations in the percentage of albuminoids do not follow the same laws. Harvest weather has little to do with the amount of albuminoids, which depend chiefly on the amount of nitrogen supplied to the root and the amount of nitrogen demanded by the grain. Roughly, it may be said that the more nitrogen the soil contains, the more albuminoids there will be in the straw, but much will depend on the amount of grain produced.

The general impression obtained during the course of these investigations is, that the reason why feeding oat straw and swedes is so successful in one district, and not in another, may be summed up in the phrase "good husbandry." When a farmer thoroughly understands cattle he obtains more dung which gives him better quality straw and roots. Feeding these again skilfully to more beasts gives him still more and still richer dung until he is able to feed beasts almost entirely on straw and roots because both are rich in albuminoids. Ultimately, of course, the farm will reach such a high degree of fertility that the local climate and soils do not permit of any further advantage. The lowest figure obtained for albuminoids is 1.1 per cent. and the highest 8 per cent., a variation so large that it is capable of explaining any difference in feeding value. Poor samples of hay often contain less than 8 per cent. of albuminoids. The highest total of sugar is 9.7 per cent. and the lowest 0.3 per cent. In other words, good oat straw has a higher feeding value than inferior hay. Old leas ploughed out and plenty of "muck" give high albuminoids; fine harvest weather gives much sugar. It is good management that secures the benefits of both these improvements in composition.

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WHAT IS "GROUND LIME"?

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THE differences between quick-lime; ground limestone, ground chalk or other forms of fairly pure carbonate of lime; and waste limes (usually impure forms of carbonate of lime) have been repeatedly explained and emphasised in numerous bulletins and reports issued by Agricultural Colleges and by various authorities responsible for agricultural education.* The relative values of these materials for agricultural purposes have been fully explained in most of these publications, but it has perhaps not been sufficiently emphasised that any or all of these substances may be, and are, sold under the name of *lime*, with or without a qualifying adjective.

At the present time many inquiries are made showing that there is still a good deal of misunderstanding as to the nature of some materials sold for the purpose of "liming" land. The loose way in which the term "lime" has been, and still is, employed is really responsible for this confusion.

The term *lime* should only be used for the material produced by burning either limestone or chalk, whether the product is ground or not.

If ground it is usually referred to as "ground lime"; if it is not ground it is often called "lump lime," "shell lime," "clot lime," or simply "quick-lime." Quick-lime, lump or ground, is the most concentrated material which can be bought for "liming" land. A fair average sample would contain 80 to 90 per cent. of calcium oxide; a good sample may contain over 90 per cent.; whereas samples, especially of ground lime, often contain less than 80 per cent. of calcium oxide, and occasionally what should be regarded as poor samples contain less than 70 per cent.†

In lump lime, shell lime, clot lime, or *ground lime*, therefore, the main constituent should be *calcium oxide*, and the proportion of all other constituents, including *carbonate of lime*, should be low—say in the neighbourhood of 5 per cent. of each.

A farmer who intends to buy the material widely and correctly known as *ground lime* should make certain that it is *burnt lime*

* See Leaflet No. 170 published by and to be obtained from the Ministry. Also Report No. 107 obtainable from the Department of Agriculture, The University, Leeds.

† These remarks on percentages of calcium oxide do not apply to magnesian limes for which the total of the percentages of the oxides of calcium and magnesium should be substituted for the calcium oxide of pure limes.

or *quick-lime* (ground) which he is obtaining and for which he is paying the price of quick-lime.

Materials are now sold, and sold at prices for which ground quick-lime can be obtained, which are not ground quick-lime at all, but which nevertheless are called ground lime.

The writer does not wish to suggest that there is any intention on the part of vendors to mislead the buyers; on the contrary, the leaflets issued by vendors advertising the materials which are not quick-lime, but which are sold under the name "ground lime" are frequently accompanied by an analysis which makes it clear to those who can properly interpret a chemical analysis that the chief constituent is not calcium oxide (lime) but calcium carbonate.

This article is written in the hope that it may draw the attention of *vendors* as well as buyers to the confusion surrounding the names of these materials, particularly "ground lime."

An inquiry from the Secretary of a branch of the National Farmers' Union may be given as a typical instance of the numerous inquiries received during the last few months.

Two materials were offered to farmers, and were called respectively "ground lime" and "ground burnt limestone." The analyses accompanying samples of these materials were roughly as follows:—

	"*Ground Lime*"	"*Ground Burnt Limestone*"
	per cent.	per cent.
Calcium Carbonate	96·0	94·5
Moisture	0·4	—
Silica, etc.	3·6	5·5

According to these analyses the materials were for practical purposes identical. The second analysis, however, was not an analysis of the material as sold—in fact it did not do the material full justice, as it was probably an analysis of the limestone rock from which the burnt lime wase produced. It could have been called "ground lime" instead of ground burnt limestone. On the other hand the material labelled "ground lime" was not entitled to that name as the chief constituent was *carbonate* of lime and the analysis in this case did apply to the material as sold. The correct name would have been "ground *carbonate* of lime," or simply "ground limestone" or "ground chalk" if the material was produced directly by grinding either limestone rock or chalk. (A good limestone and good chalk are practically the same chemically: they differ only in the structure of the rock itself which affects its hardness, etc.)

There are two other points to which attention should be drawn. There would be less need to worry about the names given to the burnt and unburnt materials if they were equally valuable *ton for ton* for the purpose (liming) to which the farmer puts them.

Ground limestone and ground chalk (under whatever names or trade-names they may be sold) are often quoted at prices per ton as high as and sometimes higher than the price of ground quick-lime. The former contains when dry say 96 per cent. of carbonate of lime, and would give an analysis of only about 53 per cent. of *calcium oxide*, whereas a ground quick-lime of good quality should contain over 80 per cent. of calcium oxide.

Many of the samples of ground limestone or ground chalk to which this article refers are excellent materials to apply to land; many of them are very finely ground, and it is on the fineness of grinding that their value depends. The writer has nothing whatever against the materials, and in the majority of cases in which lime is applied to land they would form just as satisfactory a material to use as ground quick-lime, but it requires rather less than 2 tons of finely-ground limestone or chalk to supply the same amount of the effective calcium oxide as 1 ton of ground quick-lime will supply. It follows, therefore, that the price per ton of a ground limestone or ground chalk *on the field* should be only about *half* the price per ton of ground quick-lime on the field. The price on the field is emphasised because of the extra (practically double) cost of transport and distribution in the case of the ground limestone or chalk.

Individual replies which the writer has had to such criticisms have been to the effect that finely-ground limestone cannot be produced at half the present price of ground quick-lime (except as by-products—waste materials). If that is the case then the method employed is not an economical method of reducing limestone or chalk to a condition suitable for application to the land.

The cost of producing a ground limestone or ground chalk so fine that over 90 per cent. of it would be immediately available when applied to the soil is high compared with the cost of grinding the same stone sufficiently to ensure that say 60 to 70 per cent. is of the requisite fineness. Although the coarser particles in the latter are of very little, if any, use when applied to the land the only harm they do is to lower the grade of the ground limestone and consequently to increase the cost of transport, since a

rather heavier dressing of the lower grade material will be required to supply the same weight of the effective fine material. The total absence of grittiness in a ground limestone may be necessary for other commercial purposes to which the ground limestone is put, but it is not necessary in agriculture. There is, therefore, an upper and a lower limit to the fineness of grinding of a limestone or a chalk for application to land—remembering that the material must compete in the market with quick-lime. The upper limit is determined by the cost of obtaining the last degrees of fineness: as soon as the cost of grinding becomes heavy enough to make the price of ground limestone more than half the price of ground quick-lime then ground limestone should lose its agricultural market. The lower limit is determined by the costs of transport and application of the larger dressings necessary when using low grade materials. If the grinding is such that there is only about 10 per cent. of fine material then 7 tons of the material will be required to provide as much useful material as 1 ton of a limestone of 70 per cent. fineness and the cost of transport and application would be prohibitive.

It may be taken that ground limestone or chalk passing the 60-mesh (linear) sieve is immediately available—coarser material is of some little use, but is scarcely worth considering.

The writer wishes to emphasise the fact that he is not advocating the use of coarsely-ground limestone but of sufficiently heavy applications of material which will pass the 60-mesh sieve at a cost which will compare with an equivalent application of quick-lime.

A certain small amount of coarser material is, as a matter of fact, an advantage from the point of view of uniform distribution. It is much easier to spread, either mechanically or by hand, a ground limestone or chalk which contains a small amount of gritty material than one which contains no grit at all.

* * * * * *

THE INTENSIVE SYSTEM OF POULTRY KEEPING.

LIEUT.-COLONEL F. W. HARDY.

THE intensive system is the one most suitable for town dwellers, who usually have little or no accommodation for providing a grass run. It is always better in such cases to utilize

the available site for houses only, as small earth runs are hopeless in the winter months, unless covered in, when they might just as well form a part of the house. For those who live in the country, and are able to get the land, the semi-intensive or extensive systems are better. Feeding is also cheaper, as the birds are able to pick up some of their own food, while it is generally less expensive to buy grain and meals direct from the local farmers and millers than to purchase them from the corn-chandler.

On the other hand, much better prices can be obtained for eggs in towns, where people soon find out where reliable eggs are to be had, and there should be no difficulty in getting the highest retail shop prices, or even a little more, for one's produce.

The essentials to success are:—(1) *Housing*, (2) *Feeding*, (3) *Watering*, and (4) *Cleanliness*.

(1) **Good housing** is extremely important, because the birds have to remain continuously indoors. It should fulfil the following conditions, and be (*a*) absolutely dry; (*b*) well-ventilated, yet free from perceptible draught; (*c*) light; (*d*) cool in summer, yet not unduly cold in winter, and free from violent fluctuations of temperature between day and night: these conditions are very necessary for the birds' comfort, and for egg production; (*e*) sufficiently large to allow at least 4 square feet of floor space per bird for light breeds, and 5 square feet for general purpose fowls.

It is a great economy to build one's own houses, and they can be constructed in accordance with the site available, *i.e.*, a purchased house which would do quite well for southerly aspect, might be unsuitable if it had to face west.

Floors can be made of various materials.

(*a*) Wood is good but moderately expensive, as it is no use having a thin floor, or one not properly supported. It should be either well raised above the ground to admit of a dog or cat getting underneath, or a trench must be dug around the house to the depth of a foot, and 1-in. mesh wire netting buried in this, and attached to the walls. Otherwise rats will prove troublesome.

(*b*) Concrete or tarmac are both expensive, and should not be used unless the site belongs to the poultry keeper, or is held on long lease, because such a foundation becomes the property of the landlord. Concrete is cold unless well covered with litter.

(*c*) Earth is a good and cheap material, and is more natural for the fowls' feet than (*a*) or (*b*). An earth floor may be made both rat- and damp-proof as follows:—

Some cheap fir planks, 1½ in. thick and 7 in. wide, and costing about 2d. per foot, may be cut to the length required to make a rectangular frame ¼ in. less in each direction than the framework of the house. They should be creosoted very thoroughly, then, after being placed on edge, united at the four corners with screws or long nails. The site having been roughly levelled, the frame may be placed in position and set square. This is most easily done by measuring the diagonals: when these are equal, the frame is absolutely true. Then with a spirit level it should be set quite horizontal. For a large frame, one or more cross ties will be necessary. It may now be filled in. Broken glass makes a good start, followed by clinkers from a furnace or destructor—usually to be had for the carting. The last two inches should be of clay, mixed with fine gravel, watered with a rose-can and well beaten with the back of a spade until quite smooth, and brought level with the top edge of the fir planks. The gravel is added to prevent cracking. In its absence, fine cinders or clinker will do fairly well. In a few days, according to the state of the weather, a hard, dry and impervious flooring should result.

The writer has used no other kind of floor for the past 3 years, and has found it uniformly satisfactory. Occasional repairs may be necessary, but are easily effected.

The Walls can be made of various materials, but all require a framework. It is best to make each wall separately and unite them by screws, or bolts and nuts. A house can then be quickly dismantled, and re-erected elsewhere. If at any time it is desired to sell it, purchasers are willing enough to take it.

1½ in. by 2 in. battens are quite sufficient for the framework of a house capable of accommodating 30 birds. For the uprights of the sides, however, 2 in. by 2 in. scantlings are best. The important point in frame construction is never to make halving joints, except at the ends of timbers. Elsewhere mortise and tenon, or in small houses butt joints, should be used.

It is a convenience to build houses on the semi-detached principle, because, however few birds are kept, there will be both pullets and hens requiring accommodation, and these will not prosper so well if kept together. The partition may be of wire-netting with a draught board at the rear and a wire door in front. The entrances to these pens should be at the sides, *not* in front, so that the lighting may be unobstructed. The door-posts should be mortised to the framework of the sides. The slope of the latter is important, as on this depends the fall of the roof. A drop of 1 in 4 is convenient, because rain will run off sufficiently rapidly, while calculations are much simplified, measurements on the slope being $\frac{1}{12}$nd longer than those made horizontally. Thus a house 8 ft. deep will be 8 ft. 3 in. on the slope, and to allow of sufficient overlap, the roof should be 9 ft. The walls of the house can be made of matching, feather boards, asbestos-cement, or bituminous felt.

The last-named is a very cheap and effective method, and will be further described when dealing with the roof. The front is the most complicated. It

should be not less than 6 ft. 6 in. high, but 7 ft. is better. The top 4 ft. should be covered with 1 in. mesh wire-netting (nothing bigger will keep out sparrows), the lower half of the netting being protected in front by hinged glass shutters. Above these and behind the netting, are jute hessian screens for use at night time in cold weather. When not required, they fasten back to the under-side of the roof (Fig. 1). These screens—which extend upwards to within 8 in. of the top—allow of considerable perflation of air, but prevent all draught. Above the wire netting is a projecting hood, which prevents rain driving in at the front. These details can be clearly seen in Fig. 1.

The top member of the framework of each side should be halved into the front and back uprights, 1½ in. below their summit, so as to admit the purlins of the roof taking their support from them.

The back is very simple, except that in houses over 6 ft. deep ventilators should be placed immediately below the dropping board; these can either be of glass, hinged below and falling inwards, so as to direct the incoming air on to the under-surface of these boards, or they may be of perforated zinc, which, while admitting air, will prevent any violent draught. One of these, 15 in. long and 6 in. deep, may be provided for every 5 ft. of wall space.

The Roof is often very inadequate, not so much as regards leakage, but through being far too thin, and therefore very cold in winter, and baking on a hot summer day. A cold roof produces down-draughts on the birds while perching, and will effectively stop them laying. The following construction will be found very effective both for summer and winter use; at the same time, it is cheaper to build than the ordinary pattern:—

It is convenient to use 1½ in. by 2 in. battens set on edge. The framework should be rectangular and the rafters spaced 17¼ in. apart, centre to centre. This will allow the felt, which is always 1 yd. wide, and which should run from front to rear, overlapping 1½ in. exactly on the rafters. Having made the framework and proved it true, the underside should be covered with bituminous felt secured to the rafters with plasterer's laths fixed with 1-in. nails. The frame should then be reversed and the intervals between the rafters be packed with straw. Over this should be placed 2-in. mesh wire netting tightly stretched, and fixed with staples. Over this should come another layer of felt secured with laths as before. This makes an admirable roof. It is supported on two or more purlins running from side to side and 1½ in. by 3 in. in section. The ends of the purlins are halved, so as to rest on the top members of the framework of the sides, whilst the roof is securely fixed to the walls with four or more long screws. For a large house the roof can be made in sections.

The Fittings.—Dropping boards are essential, not only from the point of view of cleanliness, but because of the part they play in ventilation, by admitting air beneeth them, without the birds on their perches being exposed to direct draught. They should be sufficiently wide, say 2 ft. 6 in., and the same height or a little more above the floor. They should make a tight joint with the back wall, yet be easily removed when required. A

fillet ¾ in. thick should be nailed along the front to enable the birds to get a secure hold when jumping up. Tar or thick creosote makes a good and impervious coating. Where possible they should be cleaned daily. If cleaning can only be done at the week-end they should be freely dusted with dry earth, wood ashes or peat moss, so as to prevent the droppings sticking, and to absorb moisture.

Perches should not be fixed in sockets but should rest on wooden blocks placed on the dropping boards. These blocks should be treated with creosote or paraffin at least once a month, as also the perches. It is as well to keep a few spares, as creosote and paraffin are liable to blister the birds' feet, unless quite dry.

Water vessels and grit boxes are best fixed on the outside, the birds having access through slits cut in the walls. The slits should be sufficiently above the floor to avoid litter being scratched into the receptacles, and a small perch will therefore be required.

Nest boxes may be inside or outside. Fig. 1 shows a good arrangement. A lifting roof is preferable to one falling outwards. In wet weather the eggs must be taken from the inside.

A wire rack for vegetables is a convenient method of feeding odd leaves which cannot well be hung.

Another type of house deserves mention—the half-monitor (Fig. 2). This is a cheap and effective method of enlarging the floor space. Both houses in this illustration have been so enlarged.

A third type is very strongly recommended, combining the advantages of the span- and pent-roof, viz., the ¾-span. It is a little more difficult to construct than the house described above. A model plan of this type can be obtained from the Ministry, price 4d. post free.

Litter.—The question of litter is of the greatest importance. The natural method for a hen to take exercise is that of scratching, not jumping. Fowls that have no exercise rapidly put on fat and soon cease laying. It is therefore necessary with poultry kept intensively to provide them with ample scratching exercise. This is effected by burying their grain ration in deep litter. The best kind is undoubtedly straw, which may be mixed with dry leaves when the latter are available. A little fresh straw—and leaves—should be added from time to time, and after scattering the grain, the latter should be quickly raked in. Peat moss may be used in place of straw, but the latter is preferable as the resulting product is much more useful for the garden.

(2) **Feeding.**—There are three systems of feeding:—(*a*) Wet mash; (*b*) Dry mash; and (*c*) Combined wet and dry. In all three methods a certain amount of grain is also fed.

(*a*) *Wet Mash* is very suitable where only a few birds—say a dozen or thereabouts—are kept, because the house-scraps provide a considerable proportion of the food. On this system the scraps are minced and set aside on the kitchen fire to simmer in water for some hours. The resulting product is then mixed, whilst still hot, with various meals, and placed in a hay-box. Afterwards it is dried off with middlings to a crumbly consistency, and fed to the birds in troughs.

(*b*) *Dry Mash* has come greatly into vogue of late. It is an immense saving of labour. The various meals are mixed dry, and fed in hoppers which are open all day, or for a limited time only, according to the concentration of the mash. It is very suitable for intensive work, because it affords the birds occupation. After eating for a short time they must go away for water, and then return. One may be delayed in getting home to feed the birds, but they never starve. They are also less subject to diarrhœa, and other digestive disturbances.

(*c*) *The Combined Wet and Dry Mash method* is very useful where it is desired to use household scraps, but it is not usually possible to feed the birds before evening, owing to other occupation from home. On this system the birds should have grain raked into the litter early in the morning, when the water-vessels should be emptied and re-filled. A member of the household should open the dry mash hoppers for four hours in the middle of the day, and the wet mash can be given last thing at night, by the light of a lantern when necessary.

A great advantage of dry mash is that it keeps quite well when stored in closed receptacles. One can make up, say, a fortnight's supply at any convenient time. The composition of mashes is too big a subject to be dealt with fully here, but a simple dry mash for laying hens is as follows:—

	lb.	
Bran	1	This is for use in winter. In summer add another lb. of bran, and reduce the Sussex ground oats to 1 lb.
Alfalfa meal	1	
Middlings	4	
Sussex ground oats ...	2	
Maize meal	1	
Fish meal	1	

There are several other foodstuffs well worthy of mention, including dried separated milk, dried yeast, maize germ meal and maize gluten meal. It is, however, often difficult to obtain

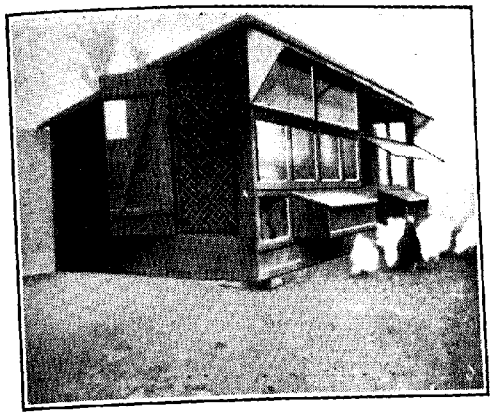

FIG. 1.—Pent-roof open-fronted Poultry House.

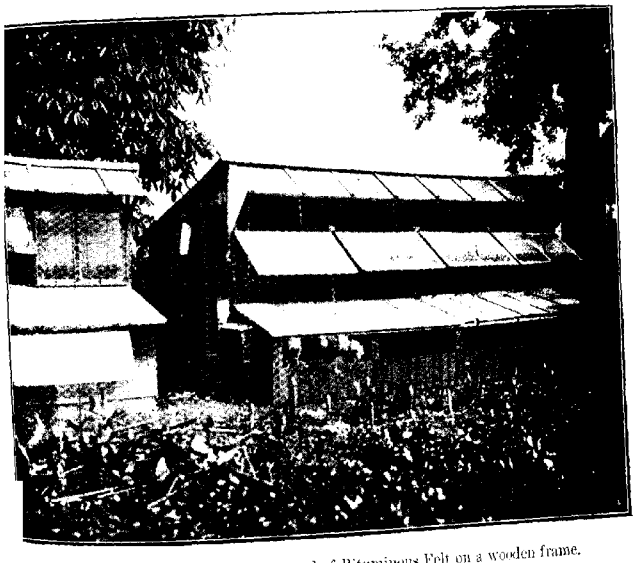

FIG. 2.—Poultry House constructed of Bituminous Felt on a wooden frame.

these in small quantities. In all feeding one should constantly handle the birds to note their condition, and make the mash more bulky or more concentrated as required.

About 1½ oz. of grain per head should be given daily. Equal parts of wheat, oats, and cracked maize make a good mixture.

Plenty of green food is essential if fowls are to be maintained in health. Birds on free range consume it largely. In confinement it must be provided for them. On a very small scale, the greengrocer may be dealt with for waste fresh cabbage leaves, etc., but he will be found too expensive for larger quantities. Here the allotment comes in. A small patch of lucerne will provide an abundance of green food from the middle of April till mid-November, whilst thousand-headed kale, marrow-stemmed kale,* cabbages, lettuces, and the different kinds of spinach, will all contribute their quota, after providing for the house. In winter, swedes and mangolds are very useful, the former before, and the latter after the turn of the year. These are best bought early and stored in a clamp or shed, protected from frost. They should be fed raw. If split in two, and impaled on a nail a foot above the floor, the birds will pick out the whole interior.

Green vegetables are rich in vitamines and mineral salts. Mangolds and swedes contain Vitamine C. in large amount, the former also about 6½ per cent. of sugar. Their mineral salts are similar to those found in green vegetables.

Fowls kept intensively will be observed to consume limestone grit, oyster-shell, etc., out of all proportion to the production of egg-shell, if their vegetable ration is restricted. How is this all to be regulated? We may safely leave it to the natural instinct of the hen. Let her have all the vegetable food she will eat, and when this is not possible, then include in the mash such things as alfalfa meal. Also, lime in some form, whether as limestone grit, or oyster or cockle-shell, should always be before the birds.

(3) **Watering.**—An egg contains about 75 per cent. of water, which is also required to regulate the concentration of the fluids of the body, to promote excretion of deleterious substances, and to control temperature by evaporation of moisture, through the medium of expired air. Birds should never be allowed to run short of water. It should be unpolluted, shaded from the sun, and protected from contamination. This is best effected by using open vessels that can be easily scrubbed and cleaned, and locating

* See Ministry's *Journal*, May, 1922, p. 177.

them outside the house as already explained. When the source of supply is of doubtful purity, a few drops of a solution of potassium permanganate may be added, but with this, earthenware, and not metal vessels must be used.

(4) **Cleanliness.**—Birds seem to pass most of their excreta during the night. The cleaning of dropping-boards has already been referred to. If the house be perfectly dry, those droppings which fall on the scratching litter soon dry, and much of them in due course is reduced to dust. Intensive houses should be cleaned out twice a year, in spring and autumn. All the fittings should first be removed, and then the litter taken away, and walls, roof and floor well brushed. If a piped water supply be available the house should be hosed down inside. Then the whole interior should be treated with a strong solution of some cresol disinfectant, using a garden syringe, and all be left to dry. After replacing the fittings, and putting in fresh scratching litter, the birds may be returned.

A continual war must be waged against red-mite, and for this purpose paraffin applied to the perches and dropping-boards is as effective and as cheap as any other insecticide.

Body lice must be kept down. For this purpose dusting boxes containing dry earth, may be provided. As a rule, however, fowls will only dust themselves—in winter-time at any rate—in the sun, and seem to prefer doing so on the floor of the house. A very little quicklime sprinkled in the litter, is considered to be a good insecticide.

In conclusion, the owner should be a friend to his birds. His movements should be quiet, the birds never being startled or frightened. It is the contented hen that delivers the goods.

Note.—Fig. 1 appeared in "Eggs," the Journal of the Scientific Poultry Breeders' Association, of 28th December, 1921, and my best thanks are due to the Editor and Publishers for the loan of the block. It shows the outside nest-boxes with roofs to lift up, the glass shutters—two open and two shut—and the jute hessian screens, of which two are buttoned back to the under surface of the roof and are consequently not seen.

Fig. 2 shows a house, the walls and roof of which consist of a double skin of bituminous felt, on either side of a wooden framework. It is an economical and durable method of construction. A half-monitor has recently been added.

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CROPS AND PLANT BREEDING: RESEARCH METHODS IN NORTH AMERICA.

I.

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THANKS to the facilities afforded by a Travelling Research Fellowship the writer was enabled to make a tour of some of the leading Experimental Stations in America during June and July last. It is proposed in this article (1) to give a brief account of the organization which exists in the United States for the purpose of co-ordinating research connected with crop culture and plant breeding, and (2) to discuss in more detail some of the methods actually employed in the conduct of these researches.* It is not intended to present an exhaustive account of the researches in progress and reference is made only to the limited number of Stations actually visited and to the work of investigators whom the writer had the pleasure of meeting.

Organization.—A clear-cut distinction is made between Animal Husbandry and Field Husbandry. Thus all the leading Experimental Stations have separate farms for the study of the problems connected with these aspects of agriculture. Crops are the concern of the Departments of Agronomy† at the Experimental Stations and of the Bureau of Plant Industry at the Federal Department of Agriculture. Plant breeding is

* Owing to illness it was not found possible fully to complete the tour as originally planned, and as a consequence it is regretted that, with the exception of the trials conducted at the Macdonald College, the writer was unable to see the work in progress in Canada. He had, however, the opportunity of meeting a large number of Canadian investigators at the Second Annual Convention of Technical Agriculturists of the Dominion, held at the Macdonald College in June.

† Agronomy has been defined in an exceedingly interesting paper by Piper (see Charles Piper, "Plants and Plant Culture," *Science*, new ser., vol. liii, No. 1,369, March, 1921) as the science of plant culture, and by Mooers (see C. A. Mooers, "The Agronomic Placement of Varieties," *Journal of the American Society of Agronomy*, vol. 13, No. 9, 1921) as "that branch of agriculture which treats of the theory and practice in the production of farm crops." Thus "Agronomy" as understood in America implies rather more than "Field Husbandry" as generally understood in this country; indeed, as practised and taught in the United States, agronomy covers the fields of both our Agricultural Botany and Field Husbandry. This is a fundamental and important difference, for whilst in this country the problems of field husbandry are chiefly the concern of the professors and lecturers in Agriculture, men who are also deeply involved in the problems of animal husbandry, in America they are the concern of the agronomist, who is by training an agricultural botanist and who devotes all his time and energy to crop problems.

regarded as being a definite branch of agronomy and is usually conducted either by an agronomist in general charge of a particular crop or by a "Plant Breeder" working under or in association with the Professor of Agronomy. At a few stations (*e.g.*, Cornell) agronomy appears to be treated as a branch of plant breeding, but be this as it may, there is always the closest possible association between the agronomist proper and the plant breeder.

The relationship between the Federal Department of Agriculture at Washington and the Experimental Stations can only be properly appreciated when the functions of the Technical Bureaux are understood. The Bureaux are in the main not only administrative but also research departments. Thus at the Bureau of Plant Industry, the Chief and all the heads of sections are technical men, practically all of whom are actively concerned with researches in the field. The closest contact is maintained between Washington and the Stations, and this is achieved by numerous researches being conducted co-operatively by the Bureau and the Stations. In some cases the salaries of special men are shared between the Bureau concerned and a particular Station, in other cases a Bureau man conducts his researches at several of the Stations. This plan appears to be fruitful of excellent results, for not only is intimate and personal contact maintained between Washington and the Stations—a contact which has rendered technical inspection superfluous—but also all the Stations working at kindred problems are kept in active and vital touch with each other. Further, from a purely scientific point of view the importance of an investigator having facilities to conduct the same researches over a wide area is of course inestimable.

Since the Bureaux are staffed by technical men it is to be expected that they and the Stations are competitors for personnel. This appears to be wholly an advantage since the staffs of both Stations and Bureaux consist largely of men who have served the one or the other previously, a fact which undoubtedly makes for cordial relations and sympathetic mutual understanding. The movement of men—even of senior men—from one post to another is not a particularly serious matter in the United States because technical agriculture is a profession absorbing, literally, thousands.*

* The technical staff at the Bureau of Plant Industry amounts to not less than 450, while the staff at the Kansas State Agricultural College at Manhattan totals about 186.

Moreover, every institute of standing has numerous post-graduate men doing research with the heads of departments, whilst every investigator in charge of any considerable research has at least one highly-trained and skilled assistant. Continuity of endeavour is thus amply safeguarded at the American Stations.

The administration and staffing of the Stations, which form an integral part of the State Agricultural Colleges, and which usually constitute a faculty of the University, are arranged with the needs of research kept well to the forefront. At most of the Stations visited the Director was also Dean of Agriculture and was thus head of the Station and of the College, when administrative duties permit of but little time for active participation in teaching or research. In many cases the heads of departments are research workers pure and simple, at most giving a few lectures to post-graduate students working in their departments; and always a large proportion of the staffs are men devoting all their time to research, while in practically all cases the members of the definitely teaching staff are themselves closely associated with the researches in progress in their several subjects. This arrangement, together with the presence of numerous post-graduate students, creates an atmosphere of inquiry, enthusiasm and good fellowship which is one of the most arresting characteristics of the leading Stations.

Very generous assistance is afforded to investigators relative to routine clerical work. Women stenographers and frequently also women calculators are allocated in plenty to the several departments—the calculating machine and the typewriter being regarded as the first essential of equipment. It is the ample clerical assistance which has made possible the elaborate recording, filing and abstracting systems everywhere in evidence. There is generally attached to the Station both a photographer and an artist.

The agronomy farms are devoted entirely to experiments: it is not the function of these farms to attempt practical farming as such but only to conduct experiments bearing upon the problems of crop culture. That this method of assisting the practical man is fully appreciated is evinced by the large numbers of farmers visiting the stations annually.

Agronomy is in America treated as an essentially outdoor science, and thus it has come about that around agronomy has developed a highly specialized field technique, a technique

which shows itself not so much in elaborate laboratory equipment as in special field and barn machinery and apparatus, ample and well-arranged greenhouses, and pot culture stations, and in remarkably thorough methods of conducting field trials, recording and interpreting the results obtained from them. All field trials are under the personal direction of the investigator, who frequently himself assists with the sowing, cultural and harvesting operations. During the growing season a large amount of this work is performed by students who are paid on a per-hour basis. At most of the Stations are to be found one or more invaluable non-scientifically trained but withal highly scientific foremen.

The Experimental Station stands pre-eminent in its State. Usually numerous sub-stations are maintained in connection with the headquarters Station. The extension work is conducted with due regard to the results obtained at the Station; thus the Director of Extension to whom the County Agents are responsible always has his headquarters at the Station.

Publications.—Publication of results is voluminous, and consequently the American literature is bewildering in its magnitude. In this country the view is frequently expressed that the volume of printed matter is unnecessarily large, a view which sometimes finds vent in the States also. It has to be remembered, however, that there are as many Experimental Stations as States in America and that the Stations are all conducting researches on numerous problems. Thus research in plant breeding is in evidence everywhere and not as in this country confined to a small number of institutions.

If serious overlapping is to be avoided frequent interim reports dealing with both methods and results are therefore a necessity. The regular writing up of the work in progress is also highly desirable in order to maintain continuity when changes of staff are not infrequent. The English investigator who is desirous of keeping in touch with American work and is not associated with a first-class library or assisted by a good abstracting system is certainly at a great disadvantage. Fortunately, however, in addition to the bulletins emanating from the Stations and Bureaux there are the American Scientific Journals, two of which in particular, namely the *Journal of the American Society of Agronomy* and the *American Naturalist*, contain matter of particular importance relative to plot technique, crop problems generally and plant breeding, though they are less generally found in our libraries than such well-known

periodicals as *The Experiment Station Record, Genetics, Journal of Agricultural Research* and the *Botanical Gazette*.

Seed Distribution.—In recent years many of the State Colleges have taken a prominent part in safeguarding the supplies of reliable seed within their province. The usual plan is to form a "Crop Improvement Association." The procedure adopted by the College at Manhattan, Kansas, for example, is briefly as follows:—The College pays the salary of a secretary and provides clerical help, while the members of the Agronomy Department inspect the crops. Membership is open to "any Kansas farmer of known integrity," and the subscription is $1.00 per annum. Members of the Association are eligible to have their seed certified. Seed is certified after inspection of the growing crop and of the harvested grain and then only in the case of standard varieties recognised by the Station as being well adapted for growing in Kansas, and which have themselves been sown with certified seed recommended by the Station. The previous cropping of the ground must also have been such as to preclude the possibility of mixing with varieties or lots of seed which may have been recently grown. At the end of the season the Station publishes a list of the names and addresses of members of the Association whose seed has been certified, together with the approximate quantity for sale. Seed is certified if all the conditions have been complied with and the inspection shows no serious defects; brief notes are, however, appended against each crop relative to freedom or the reverse from weeds, fungus diseases, and as to contamination or the reverse with other varieties.

In Kansas it has been found that the establishment of the Association has been a potent influence in the rapid distribution of improved varieties through the State. In the first instance supplies of seed are sent only to the élite of the members by whom it is subsequently further distributed.*

Methods of Research in Agronomy.—It is neither possible nor desirable to give here detailed particulars of the methods employed in the conduct of field trials. A great deal of work has been undertaken relative to methods, and much stress is laid on the difference between systematic error and non-

* In 1919 over 600 farmers were certified for "Kanred" wheat alone, and now this wheat and "Kanota" oats are firmly established throughout the State.

systematic error.* By "systematic errors" is implied errors that are inherent in an experiment and which cannot be countered by any amount of replication; "non-systematic errors" are those occasioned by soil heterogeneity and climatic conditions which can be greatly reduced by adequate replication and repetition year after year. In order to avoid systematic errors it is necessary to approximate as closely as possible to field conditions. Thus rows of cereals distanced far apart introduce scope for considerable systematic error, and varieties are affected differentially by competition and shading; plots separated by paths either unsown or sown with a different variety or species are likewise liable to grave systematic error. The general plan underlying the laying out of all experiments at the American Stations is to resort to plots of a size that will allow ample replication and to employ methods calculated to reduce systematic error to a minimum. The agronomy farms are always mapped into permanent blocks or "ranges" of as uniform soil type as possible. The ranges are usually designed to take oblong plots—for large scale trials seldom larger than 1/40 acre (the size commonly adopted at Arlington Farm, Washington, is 8 rods by $\frac{1}{2}$ rod). Such plots are very generally employed for variety, manurial, rate of sowing and other trials. The influence of competition is countered by cutting and discarding the outside margin of the plots. In the case of cereals sowing is by drill and harvesting is performed by the binder or by hand with a scythe with a cradle attached.

It is usual to replicate the plots three to five times and to use a standard variety as a check introduced at regular and frequent intervals. At Knoxville, Tennessee, the produce of such plots is wrapped in hessian, which facilitates carriage and storage until thrashing.†

For small scale work the rod row is generally employed. Rod row plots are extensively used in breeding work—selection and elimination are largely based on the results of rod row tests conducted for five to eight years and it is only strains

* See Stadler, L. J., "Experiments in Field Plot Technique for the Preliminary Determination of Comparative Yields in the Small Grains," Research Bull. 49, Univ. of Missouri College of Agriculture, Agricultural Experiment Station, which gives a detailed account of the methods largely current and a critical review of the whole subject, with 18 references to literature.

† This plan was adopted at Aberystwyth last year with oat plots 1/100 acre and proved eminently satisfactory, the crops being kept several weeks before it was possible to thrash them.

that give satisfactory results from these small scale trials that are finally tested out on larger drill-sown plots.

A very considerable technique and an equally considerable literature has grown up around the rod row.*

In order to come as close as possible to field conditions, with cereals rod rows are usually sown about 1 ft. apart—the seed being sown in drills.† It is now generally held that it adds materially to the accuracy of the trial to resort to "protected" plots—that is to say, to provide border rows which will be eliminated at the time of harvesting. On this plan each lot would consist of three rows, the two outside rows being discarded for a one row trial, or of five rows for a three row trial. The rows should run north and south. Rod row trials of this sort run continuously without any paths except the main label paths. It is usual to replicate the lots from five to ten times and a standard variety or standard varieties are frequently employed as checks.‡

The extent to which the rod row plan is adopted was a revelation, and the extensive series of such plots at Columbia (Missouri), Manhattan (Kansas), and at Cornell (Ithaca, N. York) were most convincing. The three rows are valuable for the purpose of note taking and as a unit show differential lodging in a surprisingly convincing manner.§

The rod row trial demands special technique and equipment right up to and including thrashing. The final harvested row is at Manhattan carefully tied and the ears or panicles wrapped round with paper. Special hanging arrangements are provided in airy drying rooms. These rooms usually consist of mesh wire sides and the bundles are hung in two tiers one above the

* See, e.g., H. H. Love and W. T. Craig, "Methods used and Results obtained in Cereal Investigations at the Cornell Station," *Journal of the American Society of Agronomy*, vol. 10, No. 4; T. A. Kiesselbach, "Studies concerning the Elimination of Experimental Error in Comparative Crop Tests," Research Bull. No. 13, The University of Nebraska Expt. Sta., June, 1918; H. H. Love, "The Experimental Error in Field Trials," *Journal of the American Society of Agronomy*, vol. 11, No. 6; and L. J. Stadler, *loc. cit.*

† Opinions differ as to whether the sowing is best performed by hand or with a Columbia drill—sowing by hand necessitates covering by hand, which tends to earth the drills up and therefore occasions a departure from field conditions. At Aberystwyth in the case of a trial with pure line wheats just sown this difficulty appears to have been overcome by rolling subsequent to covering.

‡ The advantages and disadvantages of checks and the precautions to be taken when employing them have been ably dealt with by Stadler (*loc. cit.*), whose paper should also be consulted for a detailed discussion relative to the *pros* and *cons* of the border row.

§ Only extensive trial can show whether the rod row test would be satisfactory in this country. Conditions favouring lodging are less continuous in the United States than, at all events, in Wales—a red raw trial badly lodged naturally presents almost insuperable difficulties relative to harvesting.

other from match-board horizontal supports. By careful arrangement all the plots of each lot are brought together and the whole produce of the trial hung and docketed in such a way as to be most convenient for thrashing. Thrashing is performed by special machines, which are designed to be easily cleaned, and are metal lined throughout, all crevices and cracks being filled with furnace cement. Under proper supervision and with adequate appliances and recording methods the rod row trial presents no particular difficulties, the men soon learning how to undertake the special work involved.

With herbage plants trials are chiefly conducted on broadcast plots. The yields are, however, in most cases reduced to dry weight; thus a part of the field equipment at Cornell is a special drying tower designed to deal with a great number of large samples (about 20 lb. green weight).

Dr. C. H. Myers at Cornell, realising the disadvantages of the broadcast plot, is now testing a method analogous to the rod row plan for strain trials with Timothy. It remains to be seen whether this will introduce a fundamental systematic error.*

In dealing with early selections and F1 and F2 seeds from hybridizations it is usual to plant in spaced rows, the row commonly employed being five feet. Actual crosses are at many of the Stations made under glass, while some of the investigators are enabled to grow their segregates at two Stations under widely different climatic conditions.†

Brief Particulars of some of the more striking Investigations in Progress.—*Variety Trials.*—A great deal of critical work is in progress relative to the conduct of variety trials and none more interesting than that of Professor Mooers. at Knoxville, Tennessee.‡

Mooers' extensive data obtained with maize in Tennessee serves to emphasise the absolute necessity of planting this crop at the correct spacing for each variety as such before attempting to make any quantitative comparisons relative to yielding capacity between one variety and another. His data bring out a further important point, namely, that the planting rate should vary according to the soil fertility, that is to say, accord-

* The row method of testing grasses and clovers is largely employed at Aberystwyth, and the matter is now under investigation in comparison with broadcast plots.

† See Love and Craig, *loc. cit.*

‡ See C. A. Mooers, "Planting Rates and Spacing of Corn," Univ. of Tennessee. Agr. Expt. Sta., Knoxville, Bull. No. 124, May, 1921, and "Agronomic Placement of Varieties," *loc. cit.*

ing to the expectancy yield. For maize in Tennessee on the richer soils more plants per acre are required than on the poorer soils. It would thus appear that in order to obtain reliable results from variety trials it is necessary to have arranged the spacing for each variety correctly having regard to the fertility of the soil upon which the trial is conducted. It has been the practice in this country to sow an equal number of germinable seeds per acre for all the varieties of oats or wheat included in a trial. It has, however, been realised by many experimenters that different varieties require different seed rates largely depending on the tillering capacity of the several varieties. It seems highly probable that with oats and wheat the fertility of the soil also exerts a profound influence on the most desirable seed rate, but as to whether the seed rate should be increased or decreased as fertility increases there is little or no available evidence in this country. Certain it is, however, that comparisons between variety trials conducted all over the country or even between those carried out within the confines of a single county are apt to be misleading or totally without significance until reliable data are collected as to the optimum seed rate required for leading varieties under diverse influences of soil and climate.

Mooers has also drawn attention to the importance of employing a reliable standard variety against which to compare the results from other varieties. He shows, moreover, that a good standard variety should be one that yields progressively well from poor to fertile soils; this, if the results are plotted from various soil classes the curve so obtained should be practically an oblique straight line. Thus, if the yields on two soil classes are obtained it is possible to prognosticate with considerable accuracy what the yields on other classes will be. The behaviour of other varieties relative to the standard then forms a scientific and accurate basis for correlating data from numerous variety trials. Mooers points out with truth that the agronomist cannot give really reliable advice as to choice of variety from a knowledge of the chemical and mechanical analysis of the soil only. The implication of his results is irresistible, *i.e.*, that better than, or at all events as well as, conducting soil and botanical surveys of a district, it would be more advantageous to map the district into soil classes by recording the behaviour of standard varieties of the chief crops, and this is probably a line of investigation well worthy of attention in this country. The work conducted by Helm

and Stadler at Columbia, Missouri,* is interesting, for they have shown that under the conditions of the short and hot growing season prevalent in that State, the early varieties of oats always outyield the medium and late, results which suggest the desirability of ascertaining for every characteristic district the relation of varieties to each other when grouped on a rapidity-of-reaching-maturity basis.

It is interesting to find the *Sterilis* varieties of oats so largely grown in latitudes where winter sowing is just possible. Fulghum and related sorts appear to be nearly as hardy as the ordinary Grey Winter (Winter Turf of America), but are in greater favour largely because they can be successfully employed as spring varieties also.†

New Introductions and Nationality Trials.—The United States and Canada alike owe much to species and varieties of plants which have been introduced from other continents; mention need only be made of Lucerne (Alfalfa) and pasture plants like Blue Grass (*Poa pratensis*),‡ Timothy§ and Japan Clover. It is therefore not surprising to find the testing of new forms and strains of species already introduced and of other species which may possibly prove useful amongst the most important activities of the Experimental Stations.

Interesting trials were seen with Japan Clover‖ at Knoxville, Tennessee, with species of *Lotus* at Arlington Farm, Washington, and with various species and forms of *Medicago* at the Macdonald College near Montreal. When starting serious breeding work with any particular species it is the first endeavour of the American investigator to "comb the world" for all possible forms and varieties of that species; this is well exemplified by the living museum of varieties of Sorghum under investigation by Professor Piper and Dr. H. V. Vinall at the Arlington Farm.

Interesting nationality trials with Red Clover were seen at several Stations (*e.g.*, at Arlington Farm and Knoxville, Tennessee) and it was noteworthy that the American-grown lots

* C. A. Helm and L. J. Stadler, "Productive Methods for Oats in Missouri," Circular No. 105, Agr. Sta., Columbia, Missouri.

† Fulghum and other *Sterilis* varieties have been tested as winter oats for two years at Aberystwyth. They have proved to be wonderfully winter hardy and very early to mature, but under our conditions are but slight croppers.

‡ See Charles V. Piper and Katherine S. Bort, "Early Agricultural History of Timothy," *Jour. Am. Soc. Agron.*, vol. 7, 1915.

§ See Lyman Carrier and Katherine S. Bort, "The History of Kentucky Bluegrass and White Clover in the United States," *ibid.* vol. 8, 1916.

‖ This plant Piper (see Charles V. Piper, "Plants and Plant Culture," *loc. cit.*), informs us was introduced accidentally in 1853 and has now spread all through the South.

appeared to be more susceptible to Mildew (*Erysiphe polygoni*) than many of the European, and that Italian Clover does not prove to be winter-hardy in the States.*

(*To be concluded.*)

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RECENT DEVELOPMENTS IN RABBIT-KEEPING FOR FUR.

E. C. RICHARDSON.

BEFORE the War, rabbit-keeping in this country was in the main confined to fanciers who strove to produce animals as nearly as possible resembling hares, or who sought after this or that symmetrical arrangement of spots or other markings. Our main supplies of rabbit fur and rabbit meat were imported, as indeed they still are.

The Belgians have long been a nation of rabbit-keepers, and their exports to us took the form of the well-known "Ostend" rabbit of commerce, and of rabbit skins sheared and dyed to imitate the furs of various wild animals. Australia and other countries where wild rabbits abound were also engaged in this business, but the best meat and the best skins were, and still are, produced from hutch-bred rabbits.

Trade names for some of the imitation furs made from rabbit-skins are "Seal Coney," "Sable Coney," "Beaver Coney," "French Sable," "Electric Seal," "Seal Musquash," etc. The trade done in these commodities has long been a large one, and with the falling off of supplies of wild furs and the increased demand for all classes of furs, it is now greater than ever.

The Beveren Club.—With the War and the submarine menace came a great rabbit boom in this country. It is to be feared that the boom did no small amount of harm in some directions, but in one way, at least, it did good, for it led to the formation of the Beveren Club.

The Beveren Club was started to promote the breeding of all kinds of rabbits which had valuable pelts, and it was called the Beveren Club because the Giant Blue Beveren, which is

* Cf. results at Aberystwyth, see "Preliminary Investigations with Herbage Plants," Bull. Series H., No. 1; and R. G. Wiggans, "Home-Grown and Imported Red Clover Seed," *Journal of the American Society of Agronomy*, vol. 13, 1921, p. 384.

one of the best of our varieties, was the first rabbit to be adopted by the Club. Since the club was started several other good varieties have been added to the list, such as Havanas, Chinchillas, Champagne Silvers and others.

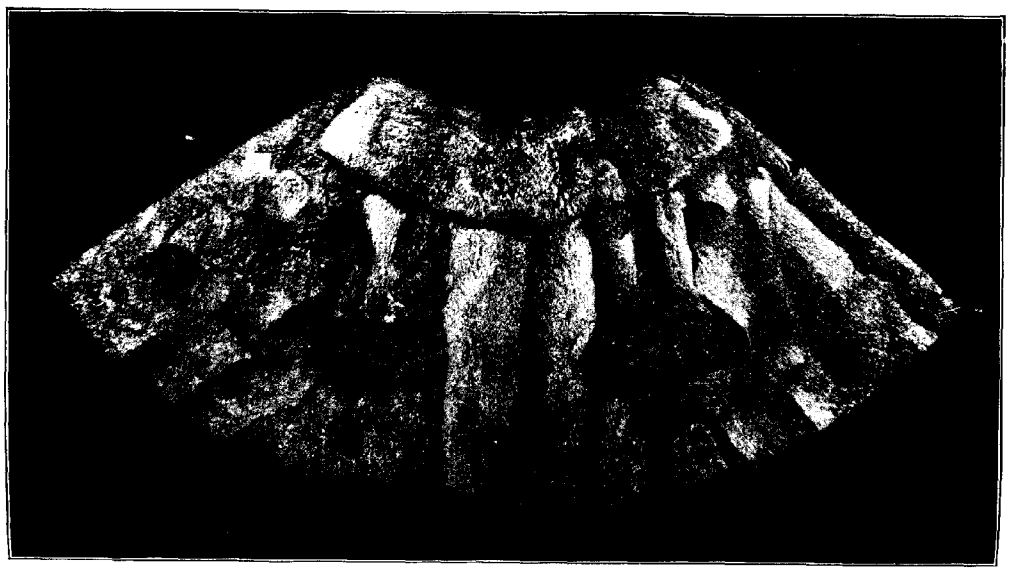
It soon became evident, however, that the breeding of these rabbits was not in itself sufficient to further the objects of the club. An outlet had to be found for the pelts and for the meat. The meat side of the problem did not offer any very great difficulty, for the rabbits were not kept, by most people, in very large numbers and the meat could be eaten at home. Moreover, there was already in existence a market for the meat, created by the Ostend trade. The pelts presented a more difficult problem, for these are beautiful things in their natural undyed and unshorn condition and, as indicated above, the existing trade in rabbit-skins is mainly confined to imitations.

The Fur Board.—Accordingly a sub-committee of the club was formed to deal with this question, and was christened "The Fur Board." The Fur Board* worked well for some time as a sub-committee, but again a difficulty arose. Money was required for the purchase of skins and the club was not a rich body. It was therefore decided to turn the Fur Board into an independent but friendly concern and to run it with private capital.

That was the position of affairs when, in the summer of 1920, the Great Eastern Railway Company started their Small Live Stock Demonstration Train. The Fur Board was asked to undertake the rabbit section on the demonstration train, and their display of furs and rabbits attracted much attention. Among other bodies interested were the Ministry of Agriculture and the Agricultural Organisation Society, and it was eventually decided that the interests of the movement as a whole would be better served if the Fur Board ceased to be a merely private concern and became a regular co-operative society affiliated to the Agricultural Organisation Society. This arrangement was carried through, and the present position is that anyone interested in rabbit-keeping can become a member of the new society which is now being run on the usual co-operative lines. The business of the society consists in the buying and selling of the *best* British rabbit skins (Beverens, Chinchillas, Havanas, Silvers, etc.), in the dressing of the skins, and in the making of them into high-class wearing apparel. The profits go towards paying a dividend on the

* Secretary, Mrs. Ker, "Heathgate," Bucklebury, Reading.

Left.—Chinchilla Rabbit Stole and Muff *(Photo. lent by W. S. Campbell)*: *Right.*—Blue Beveren Coat *(Photo. lent by Daily Mirror)*.



"Chinchillon" Child's Coat made with twelve Chinchilla Rabbit Skins *(Photo. lent by F. W. Levêque).*

share capital, after which they are divided amongst the members of the society in proportion to the value of the skins they have sold to the society, less a percentage (which is voted at the Annual General Meeting) to the Committee of Management by way of remuneration for their services.

The prices paid by the society for skins varies with the supply and the demand, and no fixed figures can be given, but as a rough guide it may be said that the best Beveren skins are at present valued at about 5s. each. As, however, the profits of the society are divided amongst the members, the price actually paid by the society by no means necessarily represents the full price ultimately received by the breeder of the pelts. During the season of 1921 the business of the society flourished and a bonus amounting to rather more than double the original value paid was paid to breeders, so that those who in the first instance received 5s. for their pelts ultimately received about 10s. or a little more. How the current season will turn out cannot as yet be predicted with certainty. All that can be said at present is that prospects seem to be fairly good.

Rabbit-Breeding as an Industry.—So much for the organisation which has been brought into being; and now for a few words of a general nature about this budding industry. Whilst the writer is of opinion that everybody who is in a position to do so (and there are few who are not) should keep a few rabbits for fur and for meat, he is not prepared to advise anybody—certainly not ex-soldiers and others who desire to start a definite business—to embark upon rabbit-keeping on a large scale. It is admitted that rabbit-keeping on a large scale *might* be profitable even now, and he is far from suggesting that it may not become so in the future, but under existing conditions the writer's view is as given above.

The rabbit undoubtedly fills a gap in the domestic economy of the nation. It can be fed, very largely, on all sorts of material which would otherwise be wasted, and which no other domestic animal will eat—with the possible exception of the goat. The initial capital required for rabbit-keeping is very small—considerably smaller than for poultry if the birds are to do well. Rabbits are silent animals, and that is no mean advantage in these days of motor horns and crowing cocks. They can be fed at any hour of the day or night. They do not retire for repose at sun-down after the manner of fowls. They do, how-

ever, need a good deal of individual care and attention, if the best results are to be achieved.

Attempts to run large numbers of rabbits together have not, so far, proved successful. In enclosed areas things may go fairly well for a year or so, but after that time there seems to be a great risk of some devastating disease attacking and decimating the whole colony. Moreover, under such conditions selection for breeding is a difficult matter. The Morant system—that of running rabbits in moveable pens on grass with a small house attached—has met with a good deal more success, but after maturity is reached both bucks and does, in most varieties at least, develop combative instincts, and this is fatal to the production of good fur. The system also has other drawbacks. On the whole, the hutch method of rabbit-keeping has, so far, proved to be much the most successful, and hutches imply cleaning out and individual attention. Again, the full adult winter coat, reached usually at the age of about 8 months, is undoubtedly the best, though some of the younger skins are also useful for certain purposes. This limits the breeding season, for nearly always (if not indeed always) those rabbits which reach maturity during the summer months have but indifferent pelts, and it can hardly be a paying proposition to keep them till they moult again for the winter months. Time may overcome these difficulties, or some of them, but at present they unquestionably exist.

There is also to be met and overcome the prevailing prejudice against wearing anything known to be rabbit fur. In the view of a writer in one of the trade papers, if rabbit fur ceased to be labelled with fancy names, and were described as rabbit fur, there would be a falling off in trade. Whilst this is a prejudice which is dying out; whilst many ladies of fashion wear our new furs and do not in the least object to their being rabbit furs: whilst some of the biggest and best known London furriers and dressmakers have in fact bought British rabbit furs and paid good prices for them; whilst in Paris some of the leading firms advertise "peau de lapin"—nevertheless, the trade in this country is, to say the least of it, timid in the matter, and prefers to stick to its "coney."

It is also to be borne in mind that though a few thousand skins were sold by the Fur Board last season, this is a mere drop in the bucket. British rabbit furs in natural colours are not yet a regular "line," there is no regular market for them, the supplies being still too small. The Fur Board, therefore, has

to make its own market, and in the absence of large supplies and a large capital expenditure in advertising, this will take time.

Lastly, there is foreign competition to be met. The imported prepared and dyed articles and the small supply of natural rabbit furs imported at present are of inferior quality to our home-produced goods. In respect of quality, there does not appear to be any great danger, but inferior though they be, foreign skins are still bought very largely by the public which, taken as a whole, is not at present very discriminating in this matter.

From every point of view therefore it would seem to be wise to go slowly but steadily forward, avoiding anything in the nature of a big plunge. We have here the makings of a new and prosperous industry. The furs themselves are beautiful things. Their admirers are steadily increasing in number. Do not let us spoil its prospects by trying to go too fast. To put the whole matter in a nut-shell: the advice given here is to keep a few of the very best rabbits and to show their pelts, made-up into wearing apparel, to as many people as possible, and thus advertise by successful examples the value of home-produced rabbit fur.

References to useful literature dealing with rabbit-breeding may be obtained on application to the Ministry.

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IMPORTATION OF CONTINENTAL GOATS.

PERCY A. FRANCIS,
Ministry of Agriculture and Fisheries.

THE importation of goats from the Continent made recently by the British Goat Society, in order to provide fresh blood for goat breeders in this country, was completed on 24th November last, when the imported animals were released from quarantine at Tilbury Docks and handed over to the respective purchasers. This importation, which has now been successfully completed, is the largest ever made into Great Britain, and constitutes perhaps the most valuable of the many efforts made by the British Goat Society to assist the development of goat-keeping in this country. The last importation, which consisted of thirteen goats, was made by the British Goat Society as long ago as 1903, and though the Society made several unsuccessful attempts to import further animals at subsequent periods they were unable, mainly for reasons in connection with precautions enforced by the Ministry of

Agriculture and Fisheries regarding foot-and-mouth disease, to make fresh importations until now.

Goat breeders in Great Britain have consequently been considerably circumscribed in their breeding operations, and many complaints have been heard in recent years regarding sterility and various forms of disease in goats, which, rightly or wrongly, have been attributed by breeders to the effects of in-breeding. That in-breeding has taken place to a considerable degree of late years is apparent if the pedigrees of the best-known strains of goats be examined, and it says much for the skill of British goat breeders, that with such limited material at their disposal they have succeeded in producing a number of goats which in all probability are not inferior as milk producers to any goats in the world. Experienced breeders, however, have long desired to obtain fresh blood, and last spring, owing to the active efforts of Lord Dewar, President of the Society, Mr. Thos. W. Palmer, the Hon. Secretary, and Mr. Herbert Hughes, the well-known Broxbourne breeder, permission was obtained from the Ministry for the Society to import goats from Holland and Switzerland on condition that certificates were produced from the Veterinary Authorities in these countries to show that the districts from which goats were purchased were free from foot-and-mouth disease; and provided the Society found suitable quarantine premises for the goats at the port of entry into Great Britain and isolated the animals for a period to be specified by the Ministry.

The Society informed its members of these conditions and invited applications from members desirous of obtaining an imported animal. Although all applicants were called upon to put up a sum estimated to cover the final cost of an imported goat and to take all risks, a fund of over one thousand pounds was quickly raised, and Messrs. Palmer and Hughes were authorised to proceed to the Continent and to purchase upwards of 50 goats. From Holland, 29 Saanen goats and from Switzerland 17 Toggenburg goats were purchased and brought into quarantine at Tilbury Docks, where for six weeks they were kept under the constant supervision of an officer of the Ministry. The goats appear to have withstood the effects of travel and quarantine remarkably well, and only one died. At the dispersal on the 24th November a few animals which had not been distributed by ballot were put up to auction, and prices varying from £10 to £16 16s. were realised. With one exception these auctioned goats were kids of last spring.

FIG. 1.—Toggenburg Goats in Switzerland—Part of the importation by the British Goat Society.

FIG. 2.—*Dutch* Cross-bred Goats near Middelburg, owned by Peasants.

FIG. 3.—Prize-winning Dutch Saanen Goats at Roermond Show, 1921.

FIG. 4.—Young Male Dutch Saanen Goats at the Stud Goat-breeding Centre of the Breda Provincial Goat-breeding Association.

Amongst breeders who obtained animals through the ballot were the Countess Bathurst, Miss Chamberlain, Lord Dewar, and Sir G. H. Fisher-Smith; whilst the Sussex County Goat Club and the West Surrey Goat Club obtained stud goats for the benefit of their respective Club members. The Irish Department of Agriculture purchased three and the United Irishwomen's Association one of the goats. The following table shows the area of distribution :—

Surrey ...	...	...	3	Hants ...	...	...	3
Yorks ...	...	...	8	Glos. ...	...	...	2
Northumberland	...		4	Ireland ...	...	...	4
Monmouth	...	...	1	Warwick	...	...	2
Lancs. ...	...	...	2	Dorset ...	...	...	1
Sussex ...	...	...	3	Wilts ...	...	...	1
Suffolk ...	...	...	3	Essex ...	...	...	2
Kent ...	...	...	3	Herts ...	...	...	3

Mr. Reginald Pease, Chairman of the Society, when expressing his thanks for the Ministry's co-operation in the importation, also expressed the hope that in the near future an official census of goats such as was taken in Ireland and several continental countries might be taken in Great Britain. He stated that it was in his opinion desirable that the practice of goat-keeping should be further extended amongst cottagers and small holders in the country and that more attention should be paid to developing the utility qualities of British goats.

The Dutch Saanen.—All the imported Saanen goats were purchased in Holland and it is of interest to note that the spread of the Saanen in Holland is a matter of recent years, though now in many Dutch provinces this is practically the only type of goat to be seen. Many importations of Saanens from Switzerland and from Hesse in Germany have been made into Holland and these importations have been encouraged and assisted by the Dutch Ministry of Agriculture, which now makes grants of approximately £1,100 annually towards the development of goat-keeping. The last official census of Dutch goats shows upwards of 300,000 animals, and no doubt the numerous breeding societies, of which there were last year upwards of five hundred and which are closely in touch with the Dutch Ministry—from whom as well as from the Provincial Authorities, the Societies derive financial assistance—are largely responsible for the development of goat-keeping in Holland. In the provinces of North Brabant and Limburg alone there were in 1920 108 Associations including 3,468 members owning 13,609 goats. These members are mainly rural workers and peasant cultiva-

tors who keep goats chiefly as a cheap source of milk supply for their families. This appears to indicate that similar difficulties have been experienced in obtaining retail supplies of cows' milk in rural districts in Holland, as is the case in many such districts in England and Wales. Holland is famous for its herds of dairy cows, which are kept in large numbers under more or less intensive conditions, but this has not prevented the rapid development in Holland of goat-keeping by the peasant and small holder classes.

The Dutch Saanen has not infrequently been crossed with the native Dutch goat, but the white colour of the Swiss Saanen has persisted in the majority of cases. At the Experimental Goat-breeding Station at Seroskerke near Middleburg, which was founded by private enterprise, but now receives support both from Provincial and State Authorities, Mynheer Zwagerman, the Director, has for some years conducted experiments to test the milking qualities of goats possessing varying proportions of the blood of the old native Dutch goat and of the imported Saanen. The native goat in its original form is credited with producing milk of higher quality but less in quantity than that of the imported animal, whilst the former is considered to possess a hardier constitution. M. Zwagerman aims at producing a type of goat more suitable than either, for Dutch conditions, and in the meantime is conducting a herdbook containing unusually detailed particulars of each animal for the goats in the Middleburg district.

A number of the Saanen goats obtained by Messrs. Palmer and Hughes were purchased in the Province of Breda, where the Provincial Goat-Breeding Association maintains a special Stud Goat-Breeding Centre. Messrs. Palmer and Hughes also visited the Province of Drenthe in search of Toggenburgs, but being unsuccessful in finding suitable animals there, they went on to Switzerland, from which country the whole of the imported Toggenburgs were obtained.

Goats in Switzerland.—Although in Switzerland private initiative in goat-breeding is regarded with a helpful and sympathetic attitude by the public authorities, in the main the breeding of Swiss goats is nearly everywhere controlled by Syndicates and Associations, which receive grants from both the Federal and the Canton Authorities. In nearly all Cantons in which goat-breeding is extensively practised, the local goat-breeding associations have united to form Breeding Unions.

In the North and the East Cantons these Unions have united into the "Union of Swiss Goat-Breeding Associations," while in the West the "Syndicat d'élevage du petit bétail du canton de Fribourg" has control of the various organisations. The German-Swiss Union has more than 9,000 members and publishes a Journal called "The Swiss Journal of Small Stock Breeding," whilst the French Union or Syndicate includes some 50 unions as well as separate breeders.

The Goat-Breeding Syndicates, of which there are about 900 in Switzerland, endeavour to facilitate the acquisition by their members of good breeding stock, especially of male animals, the encouragement of proper breeding methods and the keeping of accurate pedigrees. They also assist their members in the disposal of their stock.

In addition to these breeding syndicates there exist associations whose main function is to keep male goats, but which do not attempt to record pedigrees, this being left to the breeding syndicates.

The grants to the syndicates and associations from the Federal and Canton Authorities are partly given towards the general expenses of the organisations and partly as prizes directly for individual animals. The goats owned by the organisations have to be presented for inspection by the local and federal authorities at annual meetings, and the prizes or premiums are often not awarded until the following year, when the animals have to be presented again for inspection and the record of their work considered.

The Federal Authorities have also taken steps to prevent breeding from stud goats of inferior quality and in most of the cantons the males used for such purposes must be examined by an expert committee, and only male goats to which premiums have been awarded or approved may be employed for breeding purposes.

The principal breeds of goats kept in Switzerland are the Saanen, the Toggenburg, the Appenzell, the Chamois Mountain Goat, and the Valaisan Black-necked Goat. Of these breeds the first two are the only ones known to any extent in England.

The Saanen is widely distributed over the western part of Switzerland and is the most common goat kept for dairy purposes. It was first developed in the Saanental and Simmental of the canton of Berne, and these districts still form the headquarters of the breed. As the Saanen is adaptable and thrives

under a wide range of conditions, exports have been made from Switzerland to many countries, and this breed is now found in Holland, Germany, Austria, Serbia, Russia, France and America. The Saanen is usually hornless, of medium size and slender build. The colour is usually pure white and the hair short and thick, though on the males the coat is generally longer than on the females.

The Toggenburg derives its name from the valley of the Toggenburg, in the canton of St. Gall. The breed is also met with in the cantons of Thurgau, Schaffhausen and Zurich, and has also been exported from Switzerland to many countries. The Toggenburg is medium in size, compact in shape and hornless. The colour is light or medium brown with white stripes down the face, white rings round the ears and tail, and white feet. The coat should be short or medium in length.

Both the Toggenburg and the Saanen breeds are considered in Switzerland to be very fecund and to possess good milking qualities. Most of the Swiss Toggenburgs graze the whole summer in mountain pastures, and the hardiness of their constitution is often attributed to this fact.

It is estimated that in Switzerland there are about 350,000 goats, owned by 100,000 goat keepers, most of whom are small cultivators. Some 57 per cent. of the agricultural holdings in Switzerland are less than 5 hectares (13⅛ acres) in size. Goats are kept almost entirely for supplying milk for the families of the owners, though a certain amount of the milk is made into small soft cheeses. In many of the high valleys of Switzerland the goat often constitutes the sole source of salted meat in the household. In the cantons of Valais and Grisons, gigots (legs) of goats are smoked and are much esteemed. The fattening of kids is also extensively practised and the meat of these animals is in considerable demand. During the winter months Swiss goats are almost, if not entirely, house-fed, and that the goat is capable of thriving under these intensive conditions is shown by experience in other countries, notably in the case of Holland, where intensive methods of goat-keeping are widely adopted.

* Particulars of goat-breeding in Switzerland have been taken from "The Swiss Breeds of Goats" published by the Committee of Swiss Goat-Breeding Associations, and from a paper read, at the Congress on goat-keeping held in Holland, 1921, by Monsieur B. Collaud, Chief of the Department of Agriculture, Fribourg.

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THE TAMWORTH PIG.

SANDERS SPENCER.

THE olden type of Tamworth pig is said to have been more nearly allied in conformation and character to the original or wild hog than any other of our district or local breeds. Its long lean head, its muscular neck and shoulders were admirably suited for delving into the earth for those bulbs and roots which formed its principal food during the winter and early spring, or as soon as the supply of beechnuts, acorns, chestnuts, etc., had become exhausted. Its peculiarly shaped pricked ears, having more the appearance of a fox's lugs than the usually more or less pendant ears of a pig, were evidently so formed that the Tamworth pig in its lair in the forest should be notified of the slightest movement whether due to friend or foe. Its short body with well sprung ribs, strong loin, thick shield and long tusks made it both a powerful and dangerous enemy in the general warfare amongst the wild or semi-wild inhabitants of the vast forests in Staffordshire, Leicestershire and North Northamptonshire, where it was most commonly found.

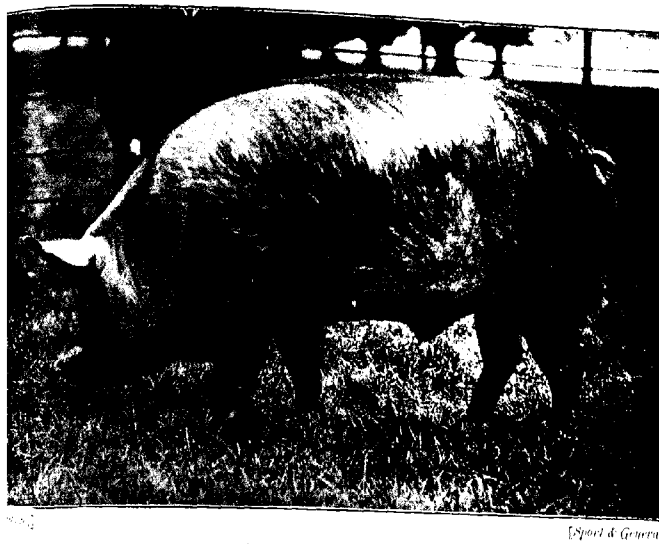
The forequarters of this rusty-coloured pig were, like those of the buffalo, giraffe and some other wild animals, much more fully developed than the hindquarters, whilst the quality of the bone of this and the other animals mentioned was more similar to that of the thoroughbred horse than to that of the rough-legged horse of the Fen districts. The mode of life with its vast amount of exercise rendered the Tamworth pig very muscular and its carcass thus produced a large proportion of lean to fat meat; consequently, its flesh was highly esteemed when preserved for winter consumption by the residents in the districts mentioned.

The present fashionable type of Tamworth pig is very unlike even the improved Tamworth of half a century ago. At the period named the original pig had been much modernised and improved, the sows were prolific and better mothers, the young pigs were vigorous, grew quickly when of some age, responded readily to good feeding, and when fattened furnished a comparatively short and heavy forequartered carcass of pork of fine quality and flavour.

The introduction about fifty years since of the cold-air chamber system of bacon curing, by which the bacon factories were

enabled to carry on their operations as satisfactorily in the summer as in the winter months, created a demand for a fat pig of quite a different character to the fashionable pig of that period. The short, fat, heavy forequartered pig was found to be totally unsuited for the manufacture of the mild cured bacon so much in demand. The necessity for the heavy salting and the accompanying large proportion of fat in the meat cured in the winter for summer consumption had passed away. The public demanded the middle portion of the side of bacon for breakfast consumption comparatively lean and long, and a small ham with a large share of lean compared with fat. As the proportion of salt-carrying lean meat increased, a much milder system of curing became necessary.

The great change in the system of curing, and the resultant enormous increase in the consumption of breakfast bacon, had the effect of calling renewed attention to the formation of the pigs for slaughter and also to the proportion and quality of the meat on the various portions of the carcass. The demand arose for fat pigs longer in the body, better developed in the hindquarters and lighter in the fore end. It is stated that various measures were tried to render the Tamworth pig more suitable for the purpose of the bacon curer. The most successful of the attempts made is alleged to have been the one adopted at a dairy factory in one of the southern counties, the manager of which imported Tamworth pigs from Staffordshire and mated them with pigs of both the Large and Middle White breeds. The more successful cross proved to be the Large White-Tamworth cross, of which a pair of yelts were exhibited at the 1881 show of the Smithfield Club, when the writer was one of the judges. There was little or no hesitation in placing these yelts at the head of their class and they eventually won the cup offered for the best pen of pigs of any cross. These pigs were of a much paler colour than the Tamworths of that period; their heads were rather shorter, their ears were longer and inclined forward, their shoulders were lighter, their backs longer and their hindquarters more fully developed. Their hams were also longer, flatter and less round. Indeed, save in colour, they were not unlike the bacon type of Large White pig of that period. In conversation with the pigman after the completion of the judging, it was admitted that the yelts were in pig and that after the conclusion of the show they were to form a portion of the breeding herd of the exhibitor. As this was before the formation of a society for the registration of



[Sport & General.

FIG. 1.—Tamworth Boar.

[Sport & General.

FIG. 2.—Tamworth Sow.

the pedigrees of the rusty-coloured pigs, it is not possible to follow these pigs and their immediate descendants.

Some of the present day breeders of Tamworths affirm their belief that the improvement which has taken place in the form and colour of these pigs has been solely due to continued selection and care in breeding. Experienced breeders know that great changes can be made over a long period of time, but in the matter of the Tamworth pig the change was very great and sudden. It has also been pointed out that one of the great difficulties attending the successful breeding of pigs of the breed is the comparatively limited number of the tribes or families of the breed. This may be due partially to too prompt closing of the herd book after the necessity for the alteration in the form and character of the Tamworth pig had impressed itself upon the minds of the breeders.

Canada appears to be the one Colony or foreign country in which the Tamworth pig has become popular. In the Dominion the red coloured pig has some strong supporters amongst those interested in bacon factories, as it has an exceedingly good effect when crossed on the Poland China and others of the lard type of pig so common on the American continent. In this country we also have had proof of the exceedingly good quality of the pork from the Tamworth pig, as some years since the Wiltshire bacon curers distributed several boars of the breed in those districts from which they drew their supplies of fat pigs. Again, only at the 1922 Dairy Show, bacon from Tamworth pigs competed successfully with that manufactured from pigs of several other breeds. The breeders of Tamworth have greatly improved their pigs of late years in lightening the forequarters and lengthening the back, but further attention to these points and to the shape of the ham might be advantageous, as it is considered that in the future the production of the bacon pig will at least be as important a point to be studied by the pig breeder as that of the pork pig.

The standard of excellence as issued by The National Pig Breeders' Association is as follows:—

Colour.—Golden red hair on a flesh coloured skin, free from black.

Head.—Fairly long, snout moderately long and quite straight, face slightly dished, wide between the ears.

Ears.—Rather long, with fine fringe, carried rigid and inclined slightly forward.

Neck.—Fairly long and muscular, especially in boar.

Chest.—Wide and deep.

Shoulders.—Fine, slanting, and well set

Legs.—Strong and shapely, with plenty of bone and set well outside the body.
Pasterns.—Strong and sloping.
Feet.—Strong and of fair size.
Back.—Long and straight.
Loin.—Strong and broad.
Tail.—Set on high and well tasselled.
Sides.—Long and deep.
Ribs.—Well sprung and extending well up to the flank.
Belly.—Deep, with straight underline.
Flank.—Full and well let down.
Quarters.—Long, wide and straight from hip to tail.
Hams.—Broad and full, well let down to hocks.
Coat.—Abundant, long, straight and fine.
Action.—Firm and free.
Objections.—Black hair, very light or ginger hair, curly coat, coarse mane, black spots on skin, slouch or drooping ears, short or upturned snout, heavy shoulders, wrinkled skin, inbent knees, hollowness at back of shoulders.

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MAKING BOXES FOR APPLES.

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THE time taken in making boxes may be greatly shortened by the use of one or two labour-saving devices. A nail stripper saves much time in picking up nails. Inquiries have been received as to where one could be purchased, but the writer has been unable to ascertain whether they are made in this country. It is, however, a simple matter to make one at home. A nail stripper is a sort of small riddle with a ridge and furrow bottom, with slots in the bottom of the furrow. These slots are of sufficient width to permit the body but not the head of a nail to pass. Nails are put in and shaken as in riddling. The nails drop through the slots until they are held by their heads and remain suspended. The stripper is then hung up in a convenient position and the nails are drawn out from the ends of the slots, all the same way up, as required for use.

The writer first tried one with the ridges and furrows made from sheet tin, but this was difficult to make true and will soon become bent and useless. The following method, however, should prove satisfactory. First make a strong framework—the corners are best dovetailed—about a foot square and 3 in. deep, with wood at least $\frac{3}{4}$ in. thick. Get seven or eight pieces of iron $\frac{1}{16}$ in. thick, $1\frac{1}{2}$ in. wide—cut true—and

$1\frac{1}{2}$ in. longer than the frame. These should be drilled to take screws at each end and in two other places, and the extra $1\frac{1}{2}$ in. should be slightly turned up. Screw these to the bottom of the framework and the outside two to the sides, as shown in Fig. 1, placing them so far apart (about $\frac{1}{8}$ in.) as just to prevent the heads of the nails passing through. At the same time cut notches in the framework above the slots or spaces—large enough to permit the nails to be withdrawn easily—at the end where the turn up is placed. This turn up prevents the nails falling out when riddling.

Then make the ridges of wood long enough to fit inside the framework and of triangular section 1 in. at the base and $\frac{3}{4}$ in. to 1 in. high. Place one of these above and upon each iron slat, so as to be $\frac{1}{4}$ in. from each edge of the metal, and screw together. Half ridges will be required at each side. The exact size of these can be ascertained after the slats have been fixed and should be such as to leave $\frac{1}{4}$ in. between the base of the ridge and the edge of the slat.

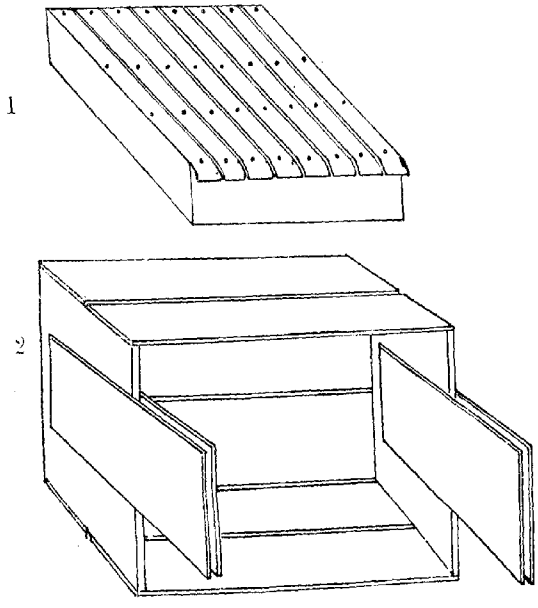

FIG. 1.—Nail Stripper; FIG. 2.—Box-Making Device.

Another very simple device for holding the pieces of wood while nailing the box together was shown by an American visitor to the Imperial Fruit Show. A box is made in the ordinary way and two pieces are nailed to the inside and outside of each end in the manner shown in the diagram, so that there is a space equal to the thickness of the ends between each pair. The box is then laid on its side about a foot from the edge of a table and nailed down. (Fig. 2.)

To make a box, two end pieces are placed upright in the spaces between the projecting pieces and against the ends of the made box, so that one of the 10½ in. sides is uppermost. One side is then nailed on. The ends are then turned round, without taking out of the slats, until the nailed-on side is next the maker, and the bottom is nailed on. Another turn, the second side is nailed on, and the box is ready for packing.

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CO-OPERATIVE ASSOCIATIONS IN CANADA.

THE agricultural co-operation movement is of comparatively recent origin in Canada, and its progress is due, amongst other causes, to the active encouragement given to it by the Federal and Provincial Departments of Agriculture and to the conditions arising out of the War. Canada being a comparatively new country, the development of agricultural co-operation has necessarily proceeded on somewhat different lines from those which it follows in older countries. Perhaps the most striking differences are the early application of co-operation to the sale of the staple agricultural products of the country, and the more rapid development of this form of co-operation in comparison with co-operative credit and the co-operative purchase of farm requisites.

Grain.—The grain industry is the most important branch of agriculture in Canada and was the first to which co-operation was applied on a large scale. The chief provinces devoting their energies to grain growing are the three prairie provinces of Manitoba, Saskatchewan and Alberta. In these provinces Grain Growers' Associations and Co-operative Elevator Companies have been formed under Acts of the Provincial Legislatures, and the Governments have made loans in aid of organisation and of the acquisition and erection of elevators up to 85 per cent. of the estimated cost.

In 1920, on the discontinuance of the Canadian Wheat Board, a Wheat Markets Committee representing the provincial farmers and grain growers' associations was formed for the purpose of establishing a wheat marketing agency as a non-profit undertaking, and a draft agreement was drawn up by which it was proposed to bind the growers to deliver to the agency (to be known as the United Farmers' Grain Corporation, with its principal office in Winnipeg) all the wheat grown by them in Canada for five years. The Corporation, on the other hand, was to agree to sell the wheat at the best prices obtainable and to pay the whole amount received less handling, grading and selling charges. The Corporation was to be authorised to establish selling, statistical or other agencies in any city in the world and was to be given power to borrow money on the wheat delivered to it for sale, and to exercise all the rights of ownership without limitation. It was not found possible, however, to bring the scheme into operation in time to deal with the 1921 wheat crop, and at the end of the year the Canadian Council of Agriculture decided not to proceed with the project but to ask the Federal Government to re-appoint the Wheat Board.

Live Stock.—The principal centres of the live stock industry of Canada are the provinces of Quebec, Ontario and Saskatchewan, and it is in these three provinces that the co-operative organisation of shipping, grading, stock-yarding and marketing has been most largely developed. It has also been organised, however, in the Maritime Provinces (Nova Scotia, New Brunswick and Prince Edward Island) and recently an export cattle-pool covering the whole of Canada has been formed by the United Grain Growers, Ltd.

In Ontario the Provincial Department of Agriculture has issued elaborate suggestions, rules and regulations for the co-operative shipping and marketing of live stock in the province, with a model of a shipping statement. In Saskatchewan the first step towards the organisation of co-operative marketing was taken by the local Department of Agriculture, which issued a bulletin in 1913 explaining the method of co-operative marketing and the benefits to be obtained therefrom. As a result, 9 incorporated co-operative stock-marketing associations were formed in 1914, and this number had increased to 54 by 1920, exclusive of the unincorporated branches of the Saskatchewan Grain Growers' Association. To encourage the

organisation of live stock marketing the Co-operative Organisation Branch of the Department supplies each new association, free of charge, with a set of receipts and account forms sufficient to record their marketing for one year, together with a bulletin explaining how the accounts should be kept.

In Quebec several of the sheep breeders' and wool producers' co-operative associations sell sheep co-operatively, their managing secretaries often being the agricultural representatives of the Department of Agriculture. In order to introduce co-operative live stock marketing in the Maritime Provinces, the Dominion Department of Agriculture in 1919 entered into an agreement with the farmers of a district near Bathurst, New Brunswick, to prepare and arrange for the co-operative sale of their sheep in the open market in the autumn of that year. Very good results were obtained from the sale and in the next year the scope of the work was extended to include cattle and hogs.

Following a visit to Great Britain in 1921 of a director and the treasurer of the United Grain Growers, Ltd., to study the live stock marketing conditions, an Export Cattle Pool was formed by the association, under which co-operative shipments were to be collected at country points and sent to Montreal where the accepted cattle would be graded and initial cash payments made according to weight and quality. After grading and payment shippers would be given participation certificates indicating the weight and quality supplied and the amount of cash advanced. Steers, heifers, cows and bulls would then be separately pooled and the gross selling price in each pool, minus cash advances and expenses, would be divided equally amongst contributors on the basis of live weight supplied. The Pool was not formed in time for the 1921 season.

Dairying.—Quebec and Ontario are the two chief dairying provinces. In Quebec a large amount of the co-operative dairying is in the hands of the Quebec Farmers' Central Co-operative Association, all the transactions of which are under the supervision of the Minister of Agriculture, who may take part at meetings of directors, appoint auditors and require the products to be graded by graders appointed by him if the interests of agriculture so require. Besides dairy products the association handles poultry, eggs, live stock, pressed meats, game, wool, vegetables, honey, maple sugar and syrup and farm requisites. The export trade of the association is facilitated by the removal

of restrictions on borrowing powers applied to other co-operative associations.

The co-operative sale of dairy products in Ontario is chiefly undertaken by the United Dairymen Co-operative, Ltd., which acts as the central selling agency for its patrons, either individuals or creameries or cheese factories, whether co-operative or otherwise. At first the company met with strenuous opposition from the local dealers and other interested persons, but it is becoming more and more the central selling agency for local cheese factories and other dairy enterprises.

Co-operative dairying in Prince Edward Island was started in 1891 when the Dominion Commissioner of Dairying visited the island and on behalf of the Dominion Government offered to supply the plant and operate a factory at a fixed charge and to market the butter and cheese, the farmers themselves erecting the necessary buildings. The success of the factory soon led to the formation of other co-operative factories.

In Saskatchewan, following the establishment of the Dairy Branch of the Department of Agriculture, an arrangement was made in 1907 whereby all the co-operative creameries voluntarily placed themselves under the supervision and direction of the Provincial Dairy Commissioner. By this arrangement the Dairy Branch engaged the managers, purchased all supplies, kept the accounts, marketed the produce and paid the patrons.

In Alberta there are about 53 co-operative creameries receiving cream according to grade and selling butter on the grades of the Dairy Commissioner of the Provincial Government. If desired, the Butter Marketing Service of the Department will act as a central selling agency, 250,000 dollars being allotted to the Department with which to make advances on butter sold. This is generally done to the amount of 80 per cent.

Wool.—The co-operative marketing of wool in Canada was started in 1914, and owes its growth almost entirely to the activity and initiative of the Dominion and Provincial Departments of Agriculture. In those early days the Departments supplied expert graders free of charge and undertook to act as central marketing agencies for any associations which might care to sell their wool in this manner. From the first the project was a success, 4 to 8 cents more per pound being obtained than could be secured by non co-operative sellers. It

was not, however, collective marketing alone that brought improvement, but the education of farmers in improving their flocks and wool and in grading and packing their produce for market. In 1917 a great step forward was made by the Dominion Government when it arranged for the proper storage in Toronto of the western wool clip and also negotiated with the banks for advances to wool growers. In 1918 the aim of the Government was achieved when the local associations all over Canada met together and formed their own central marketing association under the name of the Canadian Co-operative Wool Growers, Ltd., with headquarters in Toronto (chosen for its transport facilities and its convenience for the buyers of Great Britain and the United States) and with warehouses and branches in the different provinces of Canada. In 1920 the company marketed the wool of about 12,000 farmers, the amount received being about one-third of the total Canadian clip, of which 51 per cent. was sold to the American trade, 45 per cent. to the Canadian and 4 per cent. to the English.

Eggs and Poultry.—Co-operative marketing of eggs is now being undertaken fairly generally throughout the Dominion. Its development has been made possible by the assistance given by the Dominion Poultry Division, and not only are the amalgamated producers' associations in some instances supplying a considerable proportion of the eggs for local consumption on certain markets, but one co-operative company (the United Farmers' Co-operative Co., Ltd., of Ontario) has become one of the largest exporters in the Dominion. In all, during 1920, rather more than 3,000,000 dozens of eggs were marketed co-operatively.

In Prince Edward Island the main marketing medium is the Co-operative Egg and Poultry Association, the members of which are grouped in separate branches known as Egg and Poultry Selling Associations or "Circles," each of which is designated by a number, the individual members in each circle being likewise designated by numbers which are stamped on their eggs. Each egg circle employs a collector who has charge of the collection of all eggs, ships them to the central candling station (at Charlotte Town, where there is also a poultry killing station and a central hatchery) and apportions the return to the members according to quantity and quality received. The remuneration of the collector may be either by way of salary or commission. The produce is not bought by the Association,

but is consigned to it and sold by the business manager. A stated sum per unit is advanced on all produce received by the Association, some members being paid weekly and some monthly. The balance of the return often provides for all expenses and the reserve fund is distributed to members according to the net value of the produce marketed through the Association. This Association has served as a model for the development of co-operative egg and poultry marketing associations in various other provinces of the Dominion, but in Nova Scotia, where the conditions are different, the Poultry Department of the N.S. Agricultural College undertook to act as a central marketing agency for the local co-operative associations, taking 4 cents per dozen eggs of the proceeds of the sales for the handling and marketing expenses, the balance being paid to the managers of the local associations immediately the eggs were sold. The Department assumed no financial responsibility; it agreed to provide the outlet and assist in organising the circles, all other work devolving on the local managers.

Fruit and Vegetables.—The co-operative marketing of fruit and vegetables is most in evidence in the provinces of Ontario, Nova Scotia and British Columbia. In Ontario, which produces nearly 70 per cent. of the total fruit crop of Canada, there is no central selling organisation, and in recent years the need for the formation of such an organisation has been strongly pressed. In Nova Scotia an Act was passed in 1912 to facilitate the incorporation of Farmers' Fruit, Produce and Warehouses Associations. Under this Act, the United Fruit Companies of Nova Scotia, Ltd., was formed, primarily for the handling of apples. The central company has representatives in Havana and London, these being the two chief markets, and also an intelligence system which keeps them informed every day from all the principal markets. When a big order is received the local companies are notified to have cars ready for shipment on a certain date from the local warehouses, where the fruit is stored and inspected by the company's inspectors to ensure a uniform and high standard.

In 1915 the Annapolis Valley associations subscribed 5,000 barrels of apples for the purpose of an advertising campaign carried out by the Nova Scotia Fruit Growers' Association. In addition, the Provincial Government gave a cash contribution, and an experienced representative was sent to England to advertise Nova Scotia fruit in the principal cities.

In British Columbia an amendment to the Agricultural Associations Act was passed in 1913, whereby duly incorporated associations might secure a Government loan amounting to 80 per cent. of the subscribed capital. The work of these associations was to assemble, grade and pack according to standard rules all fruit and vegetables grown by the respective shareholders, and otherwise to prepare them for market. At the same time a united selling and buying organisation was established under the name of the Okanagan United Growers, which in the first year handled sixty-five per cent. of the crop grown in the district and is now the price-setting factor in British Columbia.

The British Columbia Fruit Growers' Association, working in conjunction with the Provincial Department of Agriculture, advertises the fruit and vegetable products of the province in the markets of Alberta and Saskatchewan. Window cards are distributed free to the dealers, bulletins are inserted in the prairie newspapers, and a free booklet of eighty pages giving recipes and methods of canning is sent to all interested. Circulars referring to the fruits in season are also issued to all retailers every few weeks.

Fruit Preserving.—In 1917 the Ontario Department of Agriculture was instrumental in equipping a small community Canning Centre at Parkhill in which some thousands of pounds of fruit and vegetables and also chickens were canned, and sent to the Canadian Forces during the war. This centre was very successful and resulted in the formation of several other centres in the province. With the cessation of hostilities, however, all the canning centres were disbanded with the exception of that at Parkhill, which is now run as a co-operative community centre.

* * * * * *

A COUNTY DEMONSTRATION FRUIT PLOT AT BEAMINSTER, DORSET.

Chas. H. Oldham,
Ministry of Agriculture and Fisheries.

With the object of demonstrating the commercial varieties of fruit most suitable for cultivation under the soil and climatic conditions obtaining in the county, and of providing facilities for instruction in the various manual processes connected with

fruit growing, the Dorset Horticultural Sub-Committee decided in 1919 to establish a fruit plot at Beaminster.

For this purpose an area of approximately one acre of land was leased from the Governors of the Beaminster Grammar School for a term of seven years, at an annual rent of £3. The site is admirably suited for fruit culture. It has natural protection on the east, and the Horticultural Superintendent states that it is unlikely to be affected by late spring frosts. The soil is typical of the district, being a deep loam, with clay subsoil, and is inclined to be on the heavy side. The drainage is natural.

The land, which was down to grass before being taken over, was thoroughly worked and cleaned by deep ploughing, subsoiling, and cross-ploughing. This work was commenced in early autumn, and planting was commenced late in the following January. The top fruit was planted 12 ft. apart in each direction, and the "half standards" staked securely. Since the plot was planted, weather conditions have not been good for young fruit trees in West Dorset, but reasonable growth has been made. Vegetable crops are being grown between the lines until the fruit trees cover the ground.

Top Fruit.—*Apples.*—The varieties of apples planted are:—Bramley's Seedling, Newton Wonder, Lane's Prince Albert, Rival, Cox's Orange Pippin, Allington Pippin, and Worcester Pearmain.

Lanes and Newtons are planted as half-standards, while the rest of the varieties are planted as "bush." Each variety has been worked on the "Paradise" stock, and planted as two-year-olds. The trees are making satisfactory growth, and appear healthy, although at the period of the visit during the late summer "leaf scorch" was seen on a few apple trees, and on Lanes a little "apple canker" was in evidence. All the trees were sprayed with lime-sulphur last February.

Pears.—The district is evidently suitable for commercial pear growing, but the distance from industrial towns would operate disadvantageously. The following sorts appear to be making satisfactory progress:—Beurre d'Amanlis, Conférence, William, Bon Chrétien, and Hessle. They have been worked on the Quince stock.

Plums.—Half-standard plums of Monarch, Czar, Victoria, and River's Early Prolific have been planted, and excellent growth has been made, especially during the past season. A

light crop was removed in 1922, and the trees are in a healthy condition.

Bottom Fruit.—The top fruit has been set in lines running north and south, with two-year-old black currants and raspberries planted between them. The black currants have been planted 6 ft. apart in the rows, and 6 ft. distant from the apple or pear trees. They consist of Booskoop Giant, Carter's Champion, and Seabrook's Black. With the exception of the last, which is showing some reversion, the bushes are doing well.

The raspberries, Hornet and Superlative varieties, are planted 18 in. apart in the rows, and 6 ft. from either row of apples or black currants. Their planting has demonstrated the commercial value of these varieties in the locality.

Nursery Bed.—Several thousand black currants have been propagated in vacant spaces around the plot, as well as apple stocks known as East Malling types 1, 4, 6 and 13. Quince stocks are being propagated with the type A (d'Angers). In due course it is hoped to distribute these types in the county of Dorset, for the benefit of growers who want reliable stocks.

Use of the Plot.—From an educational point of view this county plot may be considered to have already justified its existence, for growers in the neighbourhood visit it continually, and when planting or extending their fruit land inquire of the Horticultural Superintendent the varieties of fruit which are doing well. It has also stimulated an interest in fruit culture in the district.

During the various periods of treatment, demonstrations are arranged at the plot in such subjects as spraying, pruning, grafting and budding. These demonstrations are usually well attended and many questions are dealt with by the instructor. A hive of bees is kept on the plot to demonstrate the value of bees in fruit orchards.

Eventually, if funds are available, it is hoped to erect a shed for the purpose of holding demonstrations in the packing, grading, and storage of fruit.

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NOTES ON MANURES FOR FEBRUARY.

SIR JOHN RUSSELL, D.Sc., F.R.S.,
Rothamsted Experimental Station, Harpenden, Herts.

Accumulated Fertility resulting from the Application of Basic Slag to Grassland.—The East Suffolk results showing the improvement in fertility resulting from the addition of slag to grassland, and recorded in these notes last month, recall the work done by Professor Somerville and reported in this *Journal* (Vol. XXI, Sept., 1914, p. 481, and Vol. XXII, March, 1916, p. 1201). Slagged grassland was broken up and sown with crops, and these were compared with crops grown on some of the same grassland which had received no slag. The experiments were made in pots, and although in general pot experiments would not be considered satisfactory for the solution of an economic problem, we can safely accept Professor Somerville's deductions.

Five crops in all were taken: Oats (1914), two mustard crops (1914), wheat (1915), and mustard (1915). There were two sets of experiments; in one the crops received no further manure beyond what was already in the soil; in the other additional manure was given. Valuing the crops on the soil from unslagged grassland in each set at 100, the following yields were obtained on the soil from the slagged grassland, taken as an average over the whole five crops:—

	No further manure given.	*Manure given.*
Soil from Denton Hill ...	119 ...	108
" Cockle Park ...	170 ...	150
" Stoke Talmage ...	102 ...	109
" Arncot ...	158 ...	143
" Lees Rest ...	99 ..	102

In three out of the five cases there has been a substantial increase in crops as a result of the previous slagging of the grassland, this of course being additional to the benefits obtained from the slag while the land was under grass.

The Letchworth Bin Refuse.—The Surveyor of the Letchworth Urban District Council sends the following analysis of the bin refuse as it is now available after some reorganisation

of the methods of sorting the refuse, and the new figures are distinctly better than the old*; they are as follows:—

	per cent.
Moisture	28·60
Organic matter	18·93
Residue	52·47
Nitrogen	·62
Equivalent in ammonia	·75
Phosphoric acid	·89
Tri-basic calcium phosphate	1·94
Calcium carbonate	10·44
Oxides of iron and aluminium	7·95

Make the Crop suit the Soil.—One of the best ways of getting the most out of the farm is to find out which crops naturally grow best and to grow them so long as market conditions are favourable. An interesting example of success in this direction is given by some experiments made by Mr. W. E. D. Jones, the Agricultural Organiser of the Pembrokeshire Agricultural Education Committee. Mr. Jones realised that some of the Pembrokeshire districts which were not very successful for ordinary farming by reason of the thinness of the soil, would be eminently suitable for early potatoes. At first sight the conditions do not look favourable for farming; in the case of one farm there were only 3 inches of soil over the solid rock on a large portion of the ground tested, and even where the soil was deepest there were only 6 in. of it. Potatoes were boxed and the treatment was such as to favour early produce; the manuring was good but not excessive, the mixture being:—

3 cwt. superphosphate
2 „ sulphate of ammonia
1 „ sulphate of potash
1 „ steamed bone flour per acre

in addition to farmyard manure which had been applied in the previous autumn.

The crop was ready for lifting early in June while the prices were still high. The first lot raised realised £40 per ton and the last £18; the average for the whole crop being in the one case £21 12s., and in the other £20 per ton. The cost of growing was well below the price realised and a high rate of profit was shown, viz., £73 per acre in one case and £79 13s. in the other. It is not to be supposed that everyone could do as well as this, but the experiment illustrates the well-known fact that a change in the system may often help considerably in improving the finances of the farm by taking advantage of

* See Notes on Manures, this *Journal*, Dec., 1922, p. 839.

some local conditions which particularly favour certain special crops.

Is Phosphatic Manuring necessary for Potatoes?—A correspondent in the eastern counties has sent the results of an experiment made by himself in which superphosphate gave practically no increase in yield, the same result being given by nitrogenous and potassic manuring as by a complete fertiliser, which of course is more expensive. He asks if this is common or if it is wholly exceptional.

At Rothamsted we have recently gone over the whole of the published potato experiments in Great Britain of which we can obtain any account, and we find that out of 178 recorded trials 85 gave no response to phosphates (usually superphosphate) when nitrogenous and potassic fertilisers were present; 28 showed an increase of 10 to 20 per cent. in crop as a result of adding superphosphate and thus making the dressing complete; 47 showed an increase of more than 20 per cent. in crop; and 18 showed a decrease of more than 10 per cent.—in some cases more than 20 per cent. It thus appears that the chances of obtaining a large increase in crop as a result of applying superphosphate to potatoes is only about 1 in 4, but, as against that, the increase when it does come off is valuable. Moreover, there is little, if any, risk of loss: any superphosphate left over by the potatoes remains in the ground and can be utilised by the succeeding corn or other crops.

There is, however, always the possibility that the 18 cases—these being 1 in 10 of the trials—in which the yields were actually depressed by the use of superphosphate may represent some factor which ought to be taken into account in making up a potato manure. The results in question were obtained as a rule on light lands in the eastern and southern counties, chiefly at Bramford, Suffolk, and various Wiltshire centres. Only one case is recorded in the west or north—a light sand in Lancashire. The problem is being studied at Rothamsted. It is well known that superphosphate hastens maturity: this, indeed, is one of its valuable effects on cereal crops: and it may well happen that, in these light dry conditions the crop would have benefited by a longer growing season than the addition of superphosphate has allowed. Support is given to this view by the circumstance that at Bramford the adverse effect of superphosphate was chiefly shown on the unsprayed plots and not on the sprayed plots where the potatoes are kept growing longer.

If further investigation shows this view to be correct it will be possible to amend the formulæ for the manuring of potatoes, by increasing the amount of phosphate when required by the local conditions and decreasing the amount when this constituent is not specially needed.

Prices of Artificial Manures.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Price per ton				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	...	13.15	13. 5	13. 7	17. 3
„ „ Lime (N. 13 per cent.)	...	...	...	11.17	18. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	15.15*	15.15*	15.15*	15.15*	(N)15. 2
„ „ „ neutral (A. 25¾ per cent.)	16.18*	16.18*	16.18*	16.18*	(N)15.11
Kainit (Pot. 12½ per cent.)	...	..	2.12	2. 0	3. 2
French Kainit (Pot. 14 per cent.)	2. 5	2. 1	...	2. 5	3. 3
Sylvinite (Pot. 20 per cent.)	...	...	...	3. 0	3. 0
Potash Salts (Pot. 30 per cent.)	...	...	...	4. 5	2.10
Muriate of Potash (Pot. 50 per cent.) ...	...	8.15	9. 0	9. 0	3. 7
Sulphate of Potash (Pot. 48 per cent.) ...	...	...	12. 0	12. 0	5. 0
Basic Slag (T.P. 30-32 per cent.)	3.15§	...	...	4· 2§	2. 8
„ „ (T.P. 24-26 per cent.)	...	2.13§	...	...	...
„ „ (T.P. 20-22 per cent.)	2.12§	2. 5§	2.15§	2.15§	2. 7
„ „ (T.P. 16-18 per cent.)	2. 2§	...	2. 8§	2.11§	3. 0
Slag Phosphate (T.P. 60 per cent.) ...	6. 7§	...	...	6.15§	2. 3
„ „ (T.P. 50 per cent.) ...	...	...	5.10§	5.15§	2. 4
„ „ (T.P. 40 per cent.) ...	4. 7§	...	...	...	...
Superphosphate (S.P. 35 per cent.) ...	3.17	...	4. 2§	3.12	2. 1
„ (S.P. 30 per cent.) ...	3. 7	3. 0	3.10§	3. 5	2. 2
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 0	9. 0	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7.10†	8. 0	7. 7	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	12.10	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

Importance of proper care of Grassland.—It cannot be too strongly emphasised that grassland needs attention just as surely as does arable land, though not to the same extent. There are cases where nothing more than a dressing of slag is needed, but it is far more usual to find that something else has to be done. Drainage has to be looked to, old drains cleaned or new mole drains laid; some cultivation in the way of harrowing or rolling may be desirable; and various other work is needed. Usually grassland can be improved more easily and cheaply than

any other, but the improvement is not usually effected by simple addition of manure; indeed, it may happen that the manure is almost wasted unless drainage and cultivation receive adequate attention.

A Herefordshire Experimental Farm linked up with Rothamsted.—Mr. E. D. Simon, late Lord Mayor of Manchester, has arranged with the Rothamsted Experimental Station to devote the whole of his farm and dairy herd at Leadon Court, Herefordshire, to a thorough test of the soiling system designed by Mr. J. C. Brown, formerly of the Harper Adams Agricultural College, in which a dairy herd is maintained largely on the produce of the arable land. Mr. Simon has obtained Mr. Brown's services as resident manager, and has authorised the Rothamsted Experimental Station to publish all or any records and accounts that may be deemed helpful to farmers. It is believed that Mr. Brown's system will prove of great value, but in these difficult times the ordinary farmer could not afford to experiment on his own account, and the trial requires more land and dairy cows than could be provided at a College or an Experimental Farm. The experiment will serve a valuable purpose in showing how far the various modifications introduced will be financially advantageous to the dairy farmer, and agriculturists generally will greatly appreciate Mr. Simon's generous action.

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NOTES ON FEEDING STUFFS FOR FEBRUARY.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),
Ministry of Agriculture and Fisheries.

Feeding Salt to Pigs.—Several correspondents have drawn attention to the fact that salt is generally considered poisonous to pigs, and expressing surprise that it has been included in the mineral mixture quoted in last month's notes. The writer was aware that pigs show slight tolerance only for salt, and for this reason it is very unwise to feed pigs with feeding stuffs known to contain much salt, since salt poisoning is likely to ensue. Like all farm stock, however, pigs need a small amount of salt to keep them in good health, and the experiment quoted in last month's notes supports this view. In the case of excessive

DESCRIPTION.	Price per Qr.		Price per Cwt.	Price per Ton.	Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
	s.	lb.	s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British	44/6	504	9/11	9 18	0 18	9 0	71·6	2/6	1·34
Barley, British Feeding	30/–	400	8/5	8 8	0 14	7 14	71	2/2	1·16
„ American „	31/6	400	8/10	8 17	0 14	8 3	71	2/4	1·25
„ Danubian „	32/–	400	9/–	9 0	0 14	8 6	71	2/4	1·25
Oats, English White	31/6	336	10/6	10 10	0 16	9 14	59·5	3/3	1·74
„ „ Black & Grey	29/–	336	9/8	9 13	0 16	8 17	59·5	3/–	1·61
„ Scotch White	36/–	336	12/–	1 0	0 16	11 4	59·5	3/9	2·01
„ Canadian No. 2 Western	31/6	320	11/–	11 0	0 16	10 4	59·5	3/5	1·83
„ „ No. 3 „	29/6	320	10/4	10 7	0 16	9 11	59·5	3/3	1·74
„ „ Feed	28/6	320	10/–	10 0	0 16	9 4	59·5	3/1	1·65
„ American	28/–	320	9/10	9 17	0 16	9 1	59·5	3/1	1·65
„ Argentine	28/9	320	10/1	10 2	0 16	9 6	59·5	3/2	1·70
Maize, Argentine	39/–	480	9/1	9 2	0 15	8 7	81	2/1	1·12
„ American	38/6	480	9/–	9 0	0 15	8 5	81	2/1	1·12
Beans, English Winter	52/–	532	10/11	10 18	1 17	9 1	67	2/8	1·43
„ Rangoon	—	—	8/6	8 10	1 17	6 13	67	2/–	1·07
Peas, English, Dun	63/–	504	14/–	14 0	1 13	12 7	69	3/7	1·92
„ „ Maple	90/–	504	20/–	20 0	1 13	18 7	69	5/4	2·86
Rye, Home-grown	33/–	504	7/4	7 7	0 18	6 9	71·6	1/10	0·98
Millers' offals—									
Bran, British	—	—	—	7 0	1 11	5 9	45	2/5	1·29
„ Broad	—	—	—	8 5	1 11	6 14	45	3/–	1·61
Fine middlings (Imported)	—	—	—	8 17	1 6	7 11	72	2/1	1·12
Coarse middlings (British)	—	—	—	7 15	1 6	6 9	64	2/–	1·07
Pollards (Imported)	—	—	—	7 0	1 11	5 9	60	1/10	0·98
Barley Meal	—	—	—	10 12	0 14	9 18	71	2/9	1·47
Maize „	—	—	—	10 10	0 15	9 15	81	2/5	1·29
„ Germ Meal	—	—	—	10 10	1 2	9 8	85·3	2/2	1·16
„ Gluten-feed	—	—	—	9 5	1 12	7 13	75·6	1/10	0·98
Locust Bean Meal	—	—	—	8 0	0 11	7 9	71·4	2/1	1·12
Bean Meal	—	—	—	13 0	1 17	11 3	67	3/4	1·78
Fish „	—	—	—	15 10	5 1	10 9	53	3/11	2·10
Linseed	—	—	—	20 5	1 16	18 9	119	3/1	1·65
„ Cake, English (9% oil)	—	—	—	13 15	2 4	11 11	74	3/1	1·65
Soya Bean Cake (6% oil)	—	—	—	12 5	3 2	9 3	69·1	2/8	1·43
Cottonseed „ English (5% oil)	—	—	—	7 15	2 0	5 15	42	2/9	1·47
„ „ Egyptian (5% oil)	—	—	—	7 12	2 0	5 12	42	2/8	1·43
Coconut Cake (6% oil)	—	—	—	9 2	1 15	7 7	73	2/–	1·07
Ground-nut Cake (7% „)	—	—	—	10 10	2 2	8 8	56·8	2/11	1·56
Decorticated Ground-nut Cake (9% oil)	—	—	—	13 0	3 5	9 15	73	2/8	1·43
Palm Kernel Cake (6% oil)	—	—	—	7 0†	1 7	5 13	75	1/6	0·80
„ „ Meal (2% „)	—	—	—	6 17	1 8	5 9	71·3	1/6	0·80
Feeding Treacle	—	—		4 10	0 9	4 1	51	1/7	0·85
Brewers' grains, dried, ale	—	—		7 17	1 8	6 9	49	2/8	1·43
„ „ „ porter	—	—	—	7 7	1 8	5 19	49	2/5	1·29
„ „ wet, ale	—	—	—	1 10	0 11	0 19	15	1/3	0·67
„ „ wet, porter	—	—	—	1 6	0 11	0 15	15	1/–	0·54

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market.

salt feeding, the first symptoms in the pig are a general reddening of the skin, so that any possible trouble can be detected before it develops to a large extent.

Rationing of Dairy Cows.—A leaflet on the feeding of cows* has just been issued by the Ministry, and is of special value to stock keepers since it deals fully with the rationing of cows in accordance with the milk yield. In the production of milk, the dairy farmer's aim is to obtain, not the maximum amount of milk that the cows will give, but the maximum amount of milk consistent with economy in feeding. Thus, with heavy feeding, it may be possible to push a $2\frac{1}{2}$-gallon cow to the stage of yielding $2\frac{3}{4}$ gallons, but the process is not always economic since the last $\frac{1}{4}$ gallon may require more food than the financial return from this $\frac{1}{4}$ gallon justifies. For this reason, the writer advocates the following method of feeding according to milk yield.

The maintenance ration for the herd is drawn up in accordance with the rules given in the leaflet, the quantities of roots, straw, chaff, etc., fed depending on the amount of home-grown food available. Suitable mixtures of feeding stuffs (*see* Leaflet) are then used for every extra gallon of milk yielded. By using a suitable measure it is possible to ration every individual cow, but where for any reason it is impossible to do this, then the herd should be rationed according to the total milk yield, allowing the cowman to exercise his discretion as to individual variations in feeding.

FARM VALUES.	Value per Ton on Farm. £ s.	Manurial Value per Ton. £ s.	Food Value per Ton. £ s.	Starch Equivalent per 100 lb.	Value per unit S.E. s. d.	Market Value per lb. S.E. d.
Wheat	8 7	0 18	7 9	71·6	2/1	1·12
Oats	7 0	0 16	6 1	59·5	2/1	1·12
Barley	8 2	0 14	7 8	71·0	2/1	1·12
Potatoes	2 2	0 4	1 18	18·0	2/1	1·12
Swedes	0 18	0 3	0 15	7·0	2/1	1·12
Mangolds	0 16	0 3	0 13	6·0	2/1	1·12
Good Meadow Hay	4 19	0 16	4 3	31·0	2/8	1·43
Good Oat Straw	2 13	0 8	2 5	17·0	2/8	1·43
Good Clover Hay	5 8	1 5	4 5	32·0	2/8	1·43
Vetch and Oat Silage	2 2	0 8	1 14	14·0	2/5	1·28

If, after having checked the rations by the scientific standards, it is found that the cows are putting on flesh or falling off in condition, the *maintenance rations* should be adjusted until the correct conditions obtain. Extra cake can then be added in excess of the milk requirements, and if the extra yield of milk

* Leaflet No. 388 (*The Feeding of Dairy Cows*).

is worth more than the cost of the cake added, more cake can be added the following week until the point is arrived at where the addition of extra cake is no longer remunerative. By this means the cows are rationed on a strictly economic basis and every 1 lb. of cake fed justifies itself in an increased return in the form of milk.

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Bunt and Smut in Seed Corn.

AN important inquiry is in progress at the National Institute of Agricultural Botany, Cambridge, into the degree of prevalence of bunt and smut in seed corn. A special research grant of £100 was made to the Institute by the Development Commissioners for the purpose of carrying on this work during March-September, 1922. The seed examined was taken from the large number of samples of cereals received at the Official Seed Testing Station.

So far as wheat is concerned the inquiry for this season is complete, and the results show that of a thousand samples, chosen so as to be as representative as possible of the whole country, no fewer than 41 per cent. were contaminated with bunt. In other words, it may be assumed that 41 per cent. of seed wheat reaches the farmer infected with bunt, and what makes the position more serious is that the presence of the disease is not, in most cases, to be suspected from the appearance of the sample. A further point of interest which this inquiry has brought out is that while, judging from the samples examined, no sort of wheat is free from disease, the newer sorts, which have been in cultivation a shorter time, show a smaller percentage of infected samples than the older, which have been grown over longer periods. Again, just as no sort of wheat can boast immunity, so no district in the country can claim to be reasonably free from the disease.

As regards barley, the investigation has not gone far enough to allow definite conclusions being drawn. At present the indications are that some 15-20 per cent. of the samples are infected with spores of the covered smut (*Ustilago hordei*).

The situation thus revealed is sufficiently serious to warrant an urgent call for vigilance and care, and farmers are especially warned to take steps in good time before spring sowing for the treatment of seed corn as prescribed in the Ministry's Leaflets Nos. 92 (*Bunt and Smut in Wheat*) and 328 (*Smut in Oats and Barley*).*

* See also this *Journal*, November, 1922, p. 722.

THE following note has been contributed by Mr. W. L. Williams, as giving the impressions of a consumer visiting the last Fruit Show:—

The Imperial Fruit Show, 1922.

As an exhibition of fruit the show must be regarded as a convincing success reflecting the highest credit upon those responsible for organising it and carrying it through. Personally it was a revelation. I had no idea that fruit of such quality and variety was producible in this country. I had always believed that in fruit production we were miles behind overseas growers, within or without the Empire—that just as in some branches of industry, *e.g.*, the cotton-textile, we were unapproachable by any competitor owing to local conditions, climatic and technical, so in the domain of agriculture whilst we had a certain supremacy in some departments, *in fruit* we were hopelessly outclassed!

I have been under the necessity of revising my judgment. *We really can grow fruit*, and, if I may particularise, we can grow what I regard as the most exquisite in its appeal to the palate—*i.e.*, apples—as well as any growers in the Empire, which means as well as any in the world. I was immensely uplifted by this discovery. Of course, I ought to have known it before, but I was always told that the best fruit was imported—that even the best apples were from abroad. How could I contradict so emphatic a statement? I was born, brought up, and had all my life lived in towns, amid bricks and mortar, knowing little or nothing of trees and flowers and fruits, only knowing that some fruits appealed to me immensely and that others, strawberries to wit, gave me indigestion. Yet I must confess that the only crop I was interested in and anxious about was the apple crop. Was it good? Then I should get unlimited apples at reasonable prices—home-grown with true English flavour which at its best is beyond all doubt the most exquisite of any fruit grown anywhere. That is the kind of consumer I am—very ignorant, but very appreciative of the best and quite content to get it when I can. Thanks to those who urged me to drop politics for a few hours to come out to the Crystal Palace and learn something really valuable, I have a new idea of what the best actually is. I take off my hat to British fruit growers and tender them abject apologies for my ignorance of their achievements.

Having said that, may I be allowed to say a word or two in extenuation of my offence? As I strolled through the show and saw the exhibits—apples, pears, grapes, tomatoes, in baskets,

boxes and barrels, grown in England and Ireland (are Wales and Scotland fruitless?) and graded, packed and displayed to the very utmost advantage, to put them before the public as fruit ought to be put, thus commanding the highest possible prices—I reflected how few of my countrymen ever see fruit under such alluring conditions.

May I remind British fruit growers that the bulk of the fruit they grow is only seen by consumers in a state which is the reverse of attractive. Heaped up in forbidding masses in shop windows or on barrows—good, bad, and indifferent, mixed inextricably—is it any wonder that fruit buying is not popular and a fruit diet so limited and infrequent, that for one household—my own for example—whose meat bill is contemptible but whose fruit and vegetable bill is considerable, there are a thousand where fruit rarely enters.

Economists and captains of industry are looking for new markets, which are hard to find. It may be suggested to fruit growers that their new markets are at their doors, *i.e.*, the crowded area of our own land, and that these can be exploited to the financial advantage of producers and the bodily advantage of consumers.

Has the time not come for a break-away from ancient customs and outworn methods, not on the part of a few but on the part of all fruit growers? Let me as a mere consumer suggest :—

(1) That fruit be no longer despatched from the place of growth in bulk as it is picked but carefully graded and packed. Fruit so treated travels better, is less damaged, and commands higher prices in the open markets. Retailers, I understand, grade the fruit they have bought in bulk, but neither producer nor consumer secures any financial benefit from this process.

(2) That co-operation be more generally employed in collection and distribution. What can be accomplished has been demonstrated with other produce by the small cultivators in Holland and Denmark. Costs have been cut and production made into a profitable business proposition. We have recently heard and read of almost incredible losses by fruit growers in disposing of their produce. Why should this be the case? The consumer pays a sufficiently high price for fruit, even the commonest, to present handsome profits to the producer. In co-operation lies the solution of the problems of fruit growers. Meanwhile the mere consumer is paying top prices for inferior fruit—inferior, that is, in quality compared with price.

(3) That steps be taken to improve qualitatively fruit production. I left the exhibition with a picture glowing in my memory—a riot of colour and beauty of form—unforgettable. Within a few minutes I came across a fruiterer's shop with a display of apples, pears, etc., in the window—C.3, fruit, dirty and repulsive. Its condition was, of course, the shopkeeper's fault, but it was never good fruit—it was just the average fruit that gets into the average shop for consumption by the average citizen. Can anyone be surprised that we are not fruit lovers? It may be too much to ask all growers to reach the high standard of exhibitors, but the mass of growers might easily improve the quality of their fruit. Till they do so their industry must always be an unprofitable one.

Finally, it is worth noticing that modern hygiene emphasises the value of fruit as an article of diet. It is up to fruit growers to justify the claims of dietists. The Imperial Fruit Show sets the standard below which no wise grower will fall.

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Colorado Potato Beetle in France.

ONCE again the Colorado Beetle* has obtained a foothold in Europe, a very considerable area (stated to be about 95 square miles) in the neighbourhood of Bordeaux having been found to be infested. This outbreak, taking into account the large area involved, is the most serious which has yet occurred outside the American continent, and its relative proximity to Britain increases considerably the risk of the introduction of this dangerous pest into this country.

So long ago as 1877 Europe became greatly concerned at the possible havoc which might result if the Colorado Beetle were to become established, and it did in fact effect temporary settlements in Germany in 1877, 1887 and 1914, and in England in 1901. The fact that these invasions were in each case completely stamped out has given rise to the impression that the beetle is not the dangerous enemy it was at first represented to be. There is, however, little real ground for this optimistic point of view—in each of the previously recorded outbreaks the beetles bred freely, and at Tilbury in 1901-2 it was proved that they could withstand the English winter climate. The Bordeaux outbreak is suggested, with some reason, as being of two years' standing, and taking this into account with the large area involved it would seem impossible to assert that European conditions are unsuitable to the insect. All the evidence available therefore points to

* Leaflet No. 71 (*Colorado Beetle*) gives an illustrated description of the insect and measures for its control.

the possibility of the beetle establishing itself rather than to the reverse.

This being so, the next point of importance is the nature of the loss which the insect might cause in Great Britain, and here American experience alone is available as a guide. It would appear that in the United States of America the insect is now kept well under control and the losses which it causes in that country may be considered as confined to the expense of the necessary treatment, which consists in spraying the crops at least twice with an arsenical wash such as lead arsenate or Paris green. The same treatment would doubtless be effective in Britain, and growers can therefore estimate the losses to be anticipated from the introduction of the Colorado Beetle as the cost of spraying the crop with lead arsenate, etc., twice a year. This measure, though sufficient to prevent further loss, is unlikely ever to extirpate the pest, and it would therefore have to be accepted as part of the normal routine of potato growing.

It is clear from what has been said above that such measures as are possible should be taken to prevent the introduction of the beetle. In order to realise how far any measures are likely to be successful it is necessary to recall its habits. The great majority of the insects spend the winter as adult beetles in the soil, less frequently in rubbish, while a few may also winter as pupæ, likewise under the soil. In the spring the beetles come out and pair, and the females fly in search of potato crops on which to feed and lay their eggs. If they are unlucky in their search (and they can exist some time without food) they may fly considerable distances, but certainly not so far as from Bordeaux to Britain. They also feed and lay eggs on plants related to the potato, such as the tomato or the egg plant, and even on various unrelated weeds, but it does not seem that they can live for long on the latter. The eggs hatch into grubs which feed upon the potato foliage and are able to crawl from leaf to leaf or plant to plant but are incapable of travelling far enough to invade fresh territory. When full fed the grubs burrow in the soil, change to pupæ, and then to the adult beetles. In America there appear usually to be two generations in the summer, the adult beetles of the second generation burying themselves in the soil at the onset of cold weather.

From this account of the habits of the pest, it is clearly the adult winged beetles which are to be feared, since their capability of movement enables them (1) to fly on board ships or to crawl into packages, and (2) on arrival in a new country to fly con-

siderable distances in search of potato crops. By far the most likely time for this to happen is in the spring, when the beetles may appear before the potato tops are "through," and in consequence the females may be forced to fly a distance to find their food. The same might occur in summer or early autumn, but it is very much less likely, as in summer abundant food will be available and in autumn the beetles are seeking their winter quarters in the soil. Applying this to the French outbreak it is clearly impossible to take such measures as would prevent all risks, since it would necessitate a complete embargo on shipping from Bordeaux (to say nothing of the North American continent).

The utmost that can be done is to prohibit the type of import most likely to carry beetles, that is to say, the actual produce of the land in the infested territory. Consignments of such produce, and notably of course potatoes, being packed on farms and nurseries where the beetles actually occur may, with certain obvious exceptions such as wine or seeds, be considered the most dangerous type of import and their prohibition would result in a definite reduction of the risks which Britain must run. The embargo should be most effective next spring and early summer, but there are some grounds for putting it into operation at once since it is known that the beetles occasionally winter in places other than under the earth, while living plants imported with soil round their roots might also carry the insects.

A more difficult question to decide was the area in France which should be regarded as possibly infested. If it be accepted that the beetle has been in France for two years, there is a chance that the full range of infested territory may not yet be known, and to meet this contingency some indication of the probable maximum spread may be obtained as follows. When the beetle first became a pest in America it spread across the continent from west to east, the boundary of the infested area advancing at an average rate of 88 miles per year. In the north-eastern States, however, the spread appears to have been more rapid, reaching approximately 100 miles per year, possibly on account of the greater frequency of potato crops or of the better development of transport by which beetles might be carried. Assuming that the conditions in France correspond with those most favourable to the spread of the insect in America, which is perhaps hardly likely, the maximum area to have become infested would be that within a 200-mile radius of Bordeaux. The inclusion of such an area has actually been decided

upon, in connection with a restrictive Order under the Destructive Insects and Pests Acts, of which a summary is given on p. 1060. These restrictions will contrive such safeguards as are possible, but it must not be thought that they will remove all danger. Individual beetles may arrive at any time by means which no restrictions can prevent, and it is therefore of great importance that potato growers should warn the Ministry if they discover suspicious insects on their crops. A further statement as to the exact appearance of the pest in its different stages will be issued before the spring, when the beetles if present would make their appearance.

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REPLIES TO CORRESPONDENTS.

Soil Burning.—E.F. asks for information as to burning soil for agricultural purposes.

Reply: There are two distinct processes which may be referred to as soil burning:—(1) Clay burning, in order, as is stated in the Standard Cyclopædia of Agriculture, "to mitigate the retentive character of the soil by introducing into it a mass of material deprived of adhesive properties through the action of heat"; and (2) the process of paring and burning. Both processes have fallen more or less into desuetude but the former is still practised in road and railway engineering.

Dried Yeast for Feeding Purposes.—L.M. asks whether he should feed dried yeast to pigs for the sake of the vitamines, and O.P. also asks for information as to dried yeast as a feeding stuff.

Reply to L.M.: A mixed ration will generally contain all the vitamines the pig requires. There are three vitamines, A, B and C. A is present in cod-liver oil; B in whole grain or milling offals such as middlings and bran; C in roots. Green food such as cabbages, &c., contain all three. Yeast is rich in vitamine B, but it is not necessary to include it in a ration containing milling offals such as bran and good middlings.

Reply to O.P.: Articles on the subject appeared on page 1 of the April, 1915, number of this *Journal*, and in the Fertilizer and Feeding Stuffs Journal for 11th October, 1922. Yeast should not be included in any rations containing substances of a sugary nature such as molasses, chocolate powder or milk powder.

Willow Canker.—We are advised by clients of ours that their willows are infested with canker .... we shall esteem it a favour if you will advise us of a remedy.

Reply: The willows are affected with Willow Canker caused by the fungus *Botryosphæria gregaria*, described on page 10 of Leaflet No. 301.

It is found that the canker often occurs at the base of the rods, and unless these are cut off close to the old wood each year, canker patches may liberate spores in spring and summer which infect the new rods. It is highly important, therefore, to cut the rods right back. If this has not been done it

would pay to go over the beds again and cut the spurs back and collect or plough in the pieces cut off.

Bitter Rot of Apples.—Will you be good enough to let me know the disease apparent in the two apples sent herewith, and also the remedy to be adopted to cure it?

Reply: The apples are affected with Bitter Rot (*Glomerella cingulata*), a disease that is more common in the United States, but which does occur fairly frequently in England. The brown depressions bear a number of pink pustules, with the spores on them in pink masses. The flesh under the brown spot is said to have a bitter taste, hence the name. The rot extends until the whole apple may be involved. There is also occasionally a canker on the wood caused by the fungus, and in the spring the pink pustules appear on the depressed area of the bark.

Diseased fruit should be collected and burnt and all cankers and cankered boughs cut out. Spraying with Bordeaux Mixture as for Scab will control the disease, the most important spraying being that given about six weeks after the petals have fallen.

Mealy Bugs.—Would you let me know if there would be any harm in washing the vine rods in winter with spirits of wine?

Reply: In reply to your inquiry, the Ministry has no leaflet dealing with Mealy Bug. There would, however, be no harm in sponging the rods with spirits of wine in winter after they had been scraped as you suggest—in fact methylated spirit, which is cheaper, is one of the remedies recommended for the control of this pest.

Disease on Apple Trees.—Will you kindly inform me what the two diseases of these two apple tree specimens are?

Reply: The black objects on the apple twig are eggs of an Aphis (*Aphis pomi*). For these, spraying the tree thoroughly with lime-wash in the spring, so that all boughs and terminal shoots are well covered by the mixture, would possibly be found to be the most effective method of dealing with the pest. The operation might be undertaken in March. The enclosed Leaflet on the subject gives the formula for lime-wash.

There is also a slight amount of Mussel Scale present, upon which a Leaflet giving some information as to the pest and some suggestions for control is also enclosed.

Capsid Bugs.—Capsid Bugs appear to have done considerable damage to apples during the present season. Have you any information or suggestions for combating this pest beyond those contained in the Ministry's Leaflet on the subject, please?

Reply: As to your inquiry concerning Capsid attack on apples, there has been no notable advance in regard to the general nature of the treatment to be advised since the issue of the Ministry's Leaflet. The one point which has become more obvious is that sufficient attention is not as a rule paid to the technique of spraying. Large quantities of expensive washes, such as nicotine, are often used, but comparatively little attention is paid to ensuring their application in such a manner as to produce the best results. In the case of Capsid spraying, success is almost wholly dependent on very thorough work—to such an extent that of two growers, both using the same wash on the same day, one may obtain a 90 per cent. control and the other little commercial result for his work.

Weevils Infecting Malting Houses and Stores.—Under separate cover we are sending you a sample of the weevils infesting our malting houses and stores and we should be glad to have your report on the matter.

Reply: There were various species of weevils and beetles in your enclosure, some of them definitely harmful and others following the depredations of the rest. Among those sent were *Silvanus surinamensis*, *Calandra granaria* (the Grain Weevil), *Ptinus fur*, *Palorus* spp., and Mealworms (the larvæ of *Tenebrio molitor*), together with one or two smaller larvæ of other species not yet definitely determined. The enclosed Leaflet on hydrocyanic acid gas fumigation will give the needful particulars of this method of treatment. Needless to say the store should be cleared and very thoroughly cleaned down.

Where feasible raising the heat of the store to a temperature of approximately 130°F. should destroy the whole of the insect population therein. A little lower temperature has been found effective for some species but some are more resistant than others and therefore the higher temperature would be preferable.

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World's Dairy Congress, 1923.

THE following circular letter has been addressed by the Secretary of the World's Dairy Congress Committee for England and Wales to County Councils, County Borough Councils, and Associations and other Bodies interested in the various aspects of the dairying and milk industry in England and Wales:—

1. As you are aware, the United States of America will hold an international dairy meeting in October, 1923, under the title of the World's Dairy Congress. The initiative was taken by the United States Government, through its Department of Agriculture, in getting the movement under way. The plan was taken up with enthusiasm by those interested in dairying and dairy products, and arising therefrom the World's Dairy Congress Association was formed. This organisation will conduct the Congress with the co-operation of the United States Department of Agriculture, and the International Dairy Federation will also co-operate.

2. The Congress will be a gathering together of representatives from many nations for the purpose of seeing and hearing about the latest advances made in the field of dairying. It is believed that the Congress will be of great value to all participating countries, both from a scientific and commercial standpoint, by bringing together the leading men of scientific and commercial experience for the consideration of all the larger problems involved, with a view to making available the best information in existence concerning the importance of milk to the consumer, as well as the most effective and economic method of production, distribution and regulation.

3. Four main groups of interests are concerned, viz., those connected with:—

(*a*) *Research and Education*, e.g., teachers, investigators, engineers and other technical men interested in the solution of dairy problems.

(*b*) *Industry and Economics*, e.g., men engaged in the business of production, manufacture, export, import, storage and distribution of dairy animals, products and equipment.

(*c*) *Regulation and Control*, e.g., state, county, municipal and private officials concerned with standards, adulterations, sanitation and disease control.

(*d*) ***National Health***, e.g., public health and nutrition workers, philanthropists, welfare workers and students of the influence of diet on the health and vigour of the nation.

4. The National Dairy Association will hold its annual Exposition immediately following the Congress and in the same City. This Exposition brings together a thousand or more of the best-bred cattle of the United States and Canada, while its mechanical exhibits occupy several hundred thousand square feet of floor space. The United States Government, the Universities and Agricultural Colleges have scientific and educational exhibits at the Exposition.

5. The Ministry of Agriculture and Fisheries and the Ministry of Health were approached, through the Foreign Office, by the United States Government, and also directly by the Congress Association, on the subject of the representation of this country at the Congress. The Ministries are in full sympathy with the objects of the Congress and are prepared to accord a full measure of support to an effort to arrange for an adequate representation at the Congress of the dairying interests—educational, commercial and hygienic—in England and Wales. With this object a World's Dairy Congress Committee has been constituted for the purpose of organising this representation and of acting as a connecting link between the Congress Association and the dairying (including "public health") industry in this country. The Committee includes representatives of Government Departments, of public health bodies, and of the various interests, educational and commercial, concerned with the dairying industry.

6. At their first meeting, held on the 19th instant, the Committee elected as their Chairman, Sir Daniel Hall, Chief Scientific Adviser of the Ministry of Agriculture, and as Deputy Chairman, Sir Douglas Newton, M.P. An officer of the Ministry of Agriculture was also deputed to act as Secretary to the Committee.*

7. Action by the Committee in securing the representation of England and Wales at the Congress must be taken in two main directions:—

(*a*) Selecting a body of delegates to attend the Congress.

(*b*) Arranging for suitable papers to be read at the Congress.

8. *Selection of Delegates.*—It is probable that apart from any action taken by the Committee, certain bodies may desire to send representatives to the Congress, and to pay their expenses. There may also be individuals prominently identified with the industry who may be sufficiently interested to attend the Congress at their own expense. On the other hand, it is very probable that if the persons attending from this country are limited to those who are willing to pay their own expenses, or whose expenses are paid by an Association, adequate representation of England and Wales will not be secured. *For this reason the Committee desire to appeal for funds which would enable them to "fill the gaps," that is, to send to America such persons, who cannot be expected to pay their own expenses, as to ensure that every important aspect of the dairying industry in this country is represented in the delegation which ultimately travels to America.*

9. I am therefore instructed by the Committee to enquire:—

(*a*) Whether your intend to send a representative to the Congress at their own, or his own, expense?

* Mr. V. E. Wilkins, B.Sc.

(*b*) Failing that, whether your will be prepared to contribute towards the Fund, to be administered by the Committee, from which will be paid the expenses of such representatives as are considered necessary to complete the delegation?

The Committee earnestly trust that such a contribution will be made, and further, that in view of the considerable sum required, the contribution will be a substantial one. Contributions which individual members of your may care to make towards the Fund will be appreciated.

The Committee have appointed Mr. J. F. Blackshaw, O.B.E., the Ministry's Dairy Commissioner, to be Honorary Treasurer of the Fund. Cheques should be made payable to the "World's Dairy Congress Committee," and crossed *London County Westminster and Parr's Bank Ltd. (Charing Cross Branch).*

10. *Papers.*—The Committee would be glad to receive suggestions from your of the names (and addresses) of persons who might be invited to write papers for the Congress, with the subjects on which they would be qualified to write. Normally, papers will be written by persons who will be able to read them at the Congress, but the Committee are prepared in special cases to consider the offer of papers by those who are unable to attend. Papers of general rather than local application are desired. The Committee especially wish to receive papers dealing with *new achievements* in any branch of the dairy industry, and noteworthy advances in the sciences relative to dairying. Methods which have been found in any country to be of marked value in increasing production, lowering costs, stimulating consumption, and improving national health should be reported.

11. Finally, I am to call attention to the fact that the matter is most urgent for two reasons:—(*a*) Papers have to be in the hands of the United States authorities not later than 1st April next. (*b*) The selection of delegates must be made as soon as possible, in order that negotiations for special steamship rates may be opened and bookings fixed up.

I am therefore to ask that your will be good enough to give this matter their very earliest consideration and notify me of the decision arrived at.

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Colorado Beetle Order, 1922.—In consequence of the infestation of potato crops in the area around Bordeaux (France), dealt with above, an Order has been made by the Ministry under the Destructive Insects and Pests Acts restricting the importation of any living plants and vegetables from France. The Order, which came into operation on 1st February, 1923, prohibits the landing in England and Wales of any living plants or vegetables from any port in France (but not Algeria) unless (1) the landing is authorised by a licence issued by an Inspector of the Ministry, or (2) they are accompanied by a declaration in a form prescribed by the Order.

This declaration, signed by the grower or exporter, states that the consignment was not grown in the following Departments of France:—Gironde, Landes, Basses Pyrénées, Haute Pyrénées, Haute Garonne, Ariège, Aude, Gers, Tarn, Lot-et-Garonne, Tarn-et-Garonne, Aveyron, Lot, Dordogne, Corrèze, Cantal, Puy de Dôme, Creuse, Haute Vienne, Charente, Charente Inférieure, Indre, Vienne, Deux Sèvres, Vendée, Loire Inférieure, Maine-et-Loire, Indre-et-Loire, Lozère.

Any consignment landed without such a licence or declaration will be destroyed unless it is authorised to be disposed of otherwise by a licence issued by an Inspector of the Ministry.

"Living plants or vegetables" means trees and shrubs, tubers, bulbs and flower roots, raw vegetables including potatoes, potato haulms and leaves, and tomatoes.

A copy of the Order can be obtained from the Ministry, 10, Whitehall Place, S.W.1.

Foot-and-Mouth Disease.—One further outbreak has been confirmed in the Cheshire area since the date (18th December) referred to in the note contained on pp. 958-9 of the *Journal* for January, namely, on 23rd December, on premises at Mickle Trafford, in the vicinity of one of the previous cases. No other development having occurred, the restrictions have been withdrawn except from small areas in the immediate neighbourhood of the several infected premises.

On the 30th December, a new centre of disease was brought to light by the confirmation of disease at Ferndale in the Rhondda Valley of Glamorgan, eleven cattle on the premises being found affected. The position was somewhat disquieting inasmuch as the owner had a number of sheep grazing near the infected sheds which had access to a mountain on which approximately 1,000 sheep were running. As a matter of precaution 175 sheep which were regarded as having been in close proximity to the infected sheds were slaughtered and special arrangements were made for close observation to be maintained in respect of the remaining sheep. Fortunately, there has been no further development and it has been found possible to remove the restrictions from the outer portions of the area to which the usual standstill Order was applied.

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NOTICES OF BOOKS.

The Law of Allotments and Allotment Gardens. (E. Lawrence Mitchell. (147 pp.) London: P. S. King & Son, Ltd., 1922. 7s. 6d. net.) The growth of the demand for allotments in recent years has found legislative expression in several enactments, of which the most notable are (1) The Small Holdings and Allotments Act, 1908, (2) The Land Settlement (Facilities) Act, 1919, and (3) The Allotments Act, 1922, and any attempt to codify these Acts should be welcome to allotment societies, to members of local authorities engaged in their administration, as well as to urban landowners and others whose rights may be affected by their operation. Mr. Mitchell's administrative experience as Principal in charge of the Small Holdings and Allotments Branch of the Ministry has peculiarly fitted him to serve as a guide in this matter, and in this book he has set out concisely the powers and duties of local authorities in regard to the provision of allotments and allotment gardens, the statutory provisions governing their tenure, and the rights of tenants to compensation on dispossession. A useful feature of the book is the printing in full of the Act of 1908, indicating the amendments made by the subsequent Acts, the relative portions of which are also set out, together with the Act of 1922 and copies of Regulations and Model Rules made by the Ministry.

A Vegetable Grower's Handbook.—(Miss Fanny Bennett, F.R.H.S., and Eleanor Sinclair Rohde. (174 pp.) London: Philip Lee Warner, 1922. 6s.) "To grow good vegetables dig, dig and still dig" is the emphatic advice of the two enthusiastic gardeners who in simple language seek in this little manual to impart the fruits of their experience to others who are fortunate enough to be their own gardeners. The key-note of the style is struck in the first sentence of the book: "If seed is to germinate it must be cosy and comfortable"; and the authors' insistence on the response of the plants to love and sympathy, combined with such practical "odds and ends" economics as the use of old shaving-brushes for washing off green fly, should appeal to suburban and other amateurs who might be repelled by the more pretentious technical and scientific works on the subject.

Fruit Packing for Market.—(W. P. Seabrook. (89 pp.) London: George Allen & Unwin, Ltd., 1922. 2s. 6d. net. The increased attention now being directed to problems of marketing gives a topical interest to this treatise, which is the outcome of an invitation by the Court of the Fruiterers' Company to the Chamber of Horticulture to make suggestions for furthering the Court's desire to publish a useful yet inexpensive book calculated to assist British fruit growers in meeting the competition from Overseas. A chapter is devoted to the British Growers' Scheme for grading and packing, which was described in the *Journal* of August, 1921. Sound practical directions are given which if followed would help to raise the standard of marketing to the level which is already generally recognized as essential to successful commercial cultivation.

Efficient Marketing for Agriculture.—(Theodore Macklin, Ph.D. (418 pp.) New York and London: Macmillan & Co., 1922. 12s. 6d.) A widely distributed trisectional cartoon in the *Country Gentleman*, reproduced in this book, representing on the left-hand side the farmer selling for one dollar a basket of potatoes which is being retailed to the consumer for three dollars at the other end, asks the pertinent question "What happens in the Dark?" (represented by the black space in the middle). To answer this question is the object of the illuminating text-book by the Professor of Agricultural Economics in the University of Wisconsin, who in this volume discusses dispassionately, from the point of view of the common interests of farmers, consumers and middlemen, the economic basis of marketing and the organization of such essential services as assembling, grading and standardizing, packing, "processing" (conversion of raw materials to finished products, as wheat into flour, milk into butter, &c.), transporting, storing, financing and distributing. The various marketing agencies and methods (including co-operative and "direct" marketing are fully discussed, weaknesses in the present system are pointed out and suggestions made for improvement through the consolidation of uneconomic and inefficient middlemen wherever needless duplication exists, the establishment of working relations between farmers, middlemen and consumers and the organization of distributing agencies on the commodity basis. In the final chapter the functions of Government Authority in relation to marketing are classified as (1) maintenance of equality of opportunity; (2) securing by investigation or experimentation full facts about marketing: 3) establishment of minimum standards of competition: (4) enforcement of established standards of competition; and (5) education of the public to a comprehension of the economics of marketing.

A useful summary and bibliography is added at the end of each chapter and a very full index is appended.

Organised Produce Markets.—(J. G. Smith, M.A. (238 pp.) London: Longmans, Green & Co., 1922. 12s. 6d. net.) Though intended primarily for the use of students, this book, which is based on lectures delivered in the Faculty of Commerce of the University of Birmingham, should prove of interest and value to all who are concerned in the business of marketing—a subject which is now engaging particular attention as a branch of agricultural economics. The book gives a detailed description of the structure and working of the principal organised produce markets and exchanges in this country and in Europe and the United States, and the author's frank discussion of such abstruse and controversial subjects as the use and abuse of futures, and the influence of speculation on prices, is none the less stimulating because some of his conclusions—notably his defence of the "middleman" and the speculator in the economic scheme—would seem to challenge the doctrine of the co-operative direct marketing movement which regards the activities of these functionaries as mainly parasitic.

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SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous.

Experiments in Green Manuring for Light Soils, *H. J. Page*. (Jour. Roy. Hort. Soc., Vol. 47, Parts 2 and 3, Sept., 1922.) [63.165.]

Photoperiodism of Wheat: A Determining Factor in Acclimatization. [With Bibliography.] (Science, Sept. 15, 1922. [58(04).]

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Farm Costings in Ireland, *J. M. Adams*. (Jour. Dept. Agr., Ireland, Nov., 1922.) [657.]

Agricultural Shows, their Present Functions and how they can be Usefully Extended, *W. P. Crosland*. (Jour. Farmers' Club, 1922, Part 6.) [63(064).]

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Studies on the Effect of Nitrogen Applied to Oats at Different Periods of Growth, *W. F. Gericke*. (Jour. Amer. Soc. Agron., Nov., 1922.) [63.314.]

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Leaf Roll and Mosaic Diseases of the Potato, *P. A. Murphy* (Jour. Dept. Agr., Ireland, Nov. 1922.) [63.23.]

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